PB90-177833

Superfund Record of Decision (EPA Region 9)
Kopper's (Oroville Plant), CA. (First Remedial Action)
September 1989

(U.S.) Environmental Protection Agency, Washington, DC

13 Sep 89

U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R09-89/037	2.	3. Recipient's Accession No. PB 90 177833/AS
4. Title and Subtitle SUPERFUND RECORD OF DECISION Koppers (Oroville Plant), CA First Remedial Action - Final			5. Report Date 09/13/89 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Orgainization Name and Address			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460			13. Type of Report & Period Covered 800/000 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Koppers (Oroville Plant) site is a 200-acre operating wood treating plant in Butte County, California, just south of Oroville. The site is bordered on the west by a Louisiana-Pacific Corporation facility, which is also a Superfund site, and lies within the floodplain of the Feather River, which runs 3,000 feet to the east. Land use in the vicinity of the site is mixed agricultural, residential, commercial, and industrial. Although there is a history of wood treating operations at the site, wood treating operations were greatly expanded in 1955 when Koppers Company, Inc. became the owner and operator. Chemical preservatives including pentachlophenol (PCP), creosote, and chlorinated copper arsenate solution have been used in the wood treating processes. Wastewater discharge and other site activities have resulted in contamination of unlined ponds, soil, and debris. In 1971 PCP was detected in onsite ground water and, in 1972, in residential wells to the southwest. Pursuant to a State order, Koppers conducted cleanup activities from 1973-74, including ground water pumping and discharge to spray fields and offsite disposal of contaminated debris, and process changes, including construction of a wastewater treatment plant. In 1986 Koppers provided an alternate water supply for domestic uses to affected residents. In 1987 an explosion and fire occurred at a PCP wood treatment process facility prompting EPA to issue a removal order requiring cleanup of fire debris, and removal and stabilization (Continued on next page)

17. Document Analysis a. Descriptors

Record of Decision - Koppers (Oroville Plant), CA
First Remedial Action - Final
Contaminated Media: soil, gw
Key Contaminants: VOCs (benzene, toluene, xylenes), other organics (PAHs, PCP, dioxins/furans), metals (arsenic, chromium)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 74
	20. Security Class (This Page) None	22. Price A04

(See ANSI-Z39.18) *See Instructions on Reverse*

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

EPA/ROD/R09-89/037
Koppers (Oroville Plant), CA

16. Abstract (Continued)

of surface soil. This Record of Decision addresses the remaining contamination in onsite soil, and ground water affected by site contamination. The primary contaminants of concern affecting the soil and ground water are VOCs including toluene, xylenes, and benzene; other organics including PAHs, PCP, and dioxins/furans; and metals including arsenic and chromium.

The selected remedial action for this site includes a soil component and a ground water component. The soil remedy includes four discrete soil treatment areas: in situ biodegradation of 110,000 cubic yards of PCP-contaminated soil; excavation and soil washing of 200,000 cubic yards of soil contaminated with wood treating wastes with redisposal of treated soil onsite and treatment of residual contamination in the washing fluid in an onsite treatment facility; installation of a low permeability cap over the wood treating process area and downgradient extraction wells with future treatment of 20,000 cubic yards of contaminated soil beneath this area as soil becomes accessible during equipment change or ceasing of operations; and excavation and chemical fixation of 4,000 cubic yards of soil contaminated with metals, followed by onsite disposal. The ground water remedy includes pumping and treatment of approximately 22,000,000 cubic yards of ground water using activated carbon, and reinjection of treated waste to the ground water; and formalization of the provision of an existing alternate water supply and extension, if needed, of the water supply during implementation of the remedy. The estimated present worth cost for this remedial action is $77,700,000, which includes an estimated present worth O&M cost of $37,100,000.

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R09-89/037
September 1989

PB90-177833

EPA

Superfund Record of Decision:

Kopper's (Oroville Plant), CA

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

KOPPERS SUPERFUND SITE
OROVILLE, CALIFORNIA

OPERABLE UNIT RECORD OF DECISION

United States Environmental Protection Agency
Region IX - San Francisco, California
September, 1989

KOPPERS RECORD OF DECISION
TABLE OF CONTENTS

SECTION	PAGE
Declaration	1
Decision Summary	4
1.0 Site Name, Location, Description	4
2.0 Site and Enforcement History	6
3.0 Community Participation	9
4.0 Scope and Role of Decision	10
5.0 Summary of Site Characteristics	11
6.0 Summary of Site Risks	17
7.0 Description of Alternatives	30
8.0 Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered Criteria	38
9.0 Summary of Comparative Analysis of Alternatives	46
10.0 Selected Remedy	61
11.0 Documentation of Revisions to the Proposed Plan	66
12.0 Statutory Determinations	67

Declaration

SITE NAME AND LOCATION

Koppers Company, Inc.
Oroville, CA

STATEMENT OF BASIS AND PURPOSE

This decision document presents selected soil and ground water remedial actions for the Koppers site in Oroville, California, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act, as amended by the Superfund Amendments and Reauthorization Act (CERCLA), and to the extent practicable, the National Contingency Plan. This is considered an Operable Unit Record of Decision (ROD). Investigatory work related to this site is ongoing, and could potentially lead to additional CERCLA actions, or actions pursuant to other statutory authority, at this site. This decision is based on the administrative record for this site.

The State of California has concurred with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, and the environment.

DESCRIPTION OF THE REMEDY

This remedy includes EPA's first remedial actions selected for this site and addresses the documented public health threats from the site contamination. Actions have been selected to address onsite soils, on and offsite ground water, and the continuation of an alternative water supply until the ground water cleanup meets EPA's remedial objectives.

The selected soil remedy includes:

- In situ biodegradation of approximately 100,000 cubic yards of soil contaminated primarily with pentachlorophenol.

- Excavation and treatment by soil washing of approximately 200,000 cubic yards of soil contaminated with a variety of wood treating wastes. The treated soil will be redisposed of on the site. Residual contamination in the washing fluid will be treated in an onsite waste water treatment facility.

- Installation of a low permeability cap over the currently active wood treating process area, along with the installation of extraction wells downgradient of this area to prevent the migration of contamination into the surrounding ground water. When contaminated soil beneath the process area is accessible, either when process equipment is replaced or when wood treating operations cease, this contaminated soil will be remediated to the same remedial objectives as the aforementioned two soil units.

- Excavation and treatment by chemical fixation of soils contaminated with metals used in the wood treating processes. The treated soils will be disposed of on the site.

The selected ground water remedy includes:

- Extraction of contaminated ground water, treatment using activated carbon, and reinjection of treated water to the ground water. Contaminated residuals from the carbon treatment will be treated by biodegradation.

- Formalization of the provision of an alternative water supply to residents with contaminated wells during implementation of the remedy. (An alternative water supply has been provided by Koppers since early 1986.) Water provided will be sufficient in volume to preclude use of contaminated residential wells for any purpose, and to prevent the use of wells that would adversely affect the pump and treat remediation of contaminated ground water.

Site specific treatability studies have shown that activated carbon sucessfully removes contamination from ground water. Other selected treatment methods will be tested on site soils and groundwater during remedial design to demonstrate their effectiveness.

The aforementioned actions will address all documented threats from the site. Investigatory work is currently underway on an additional area that might result in future response actions under CERCLA or other regulatory authority. These involve air emissions from wood treating operations at the site.

STATUTORY DETERMINATIONS

The selected remedies are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial actions, and are cost-effective. These remedies utilize permanent solutions and alternative treatment technologies to the

maximum extent practicable and satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. As this remedy involves treatment that will take approximately twenty to thirty years to reach remedial objectives, a review will be conducted every five years after commencement of remedial actions to ensure that the remedy continues to provide adequate protection of human health and the environment.

John Wise

Daniel W. McGovern for
Regional Administrator

9.13.89
Date

Decision Summary

1.0 Site Name, Location, Description

The Koppers Company site is located in Butte County just south of the city limits of Oroville, California. (See Figure 1-1, Site Location Map) The facility is a 200-acre operating wood treating plant. The Koppers site is bordered on the west by the Louisiana-Pacific Corporation facility, which is also on EPA's Superfund National Priorities List.

The western boundary of the Koppers site is about 3000 feet east of the Feather River. The site lies in the Feather River flood plain, which is approximately 2.7 miles wide near the site. The site lies about 145 feet above sea level, while the Feather river is about 130 feet above sea level. Gold mining dredge operations occurred in the early 1900's in the area of the Koppers site. Tailing piles from this dredging remain on the northern part of the site. These piles rise 150 feet above sea level. To the east and southeast of the plant are hills which rise 250 to 300 feet above sea level.

Surface water runoff flows from the Koppers site to the west onto the neighboring Louisiana-Pacific facility. This water flows primarily in a ditch between the two sites, and through a channel which traverses the Koppers site's spray fields in a generally northeast to southwest direction.

The geology underlying the site consists of gravels, sands, and clays that were deposited by the Feather and ancestral Feather River systems. Several interconnected aquifer zones have been defined on and off the site. The regional ground water flow is generally to the south, with upper aquifers demonstrating some southwesterly components.

Land use in the vicinity of the site is mixed agricultural, residential, commercial, and industrial. One- to five-acre farms exist, and much of the produce and livestock is raised for home use and not sold commercially. Residential areas are located to the south, southeast, west, and northeast of the site. Three schools are located within a two-mile radius of the site.

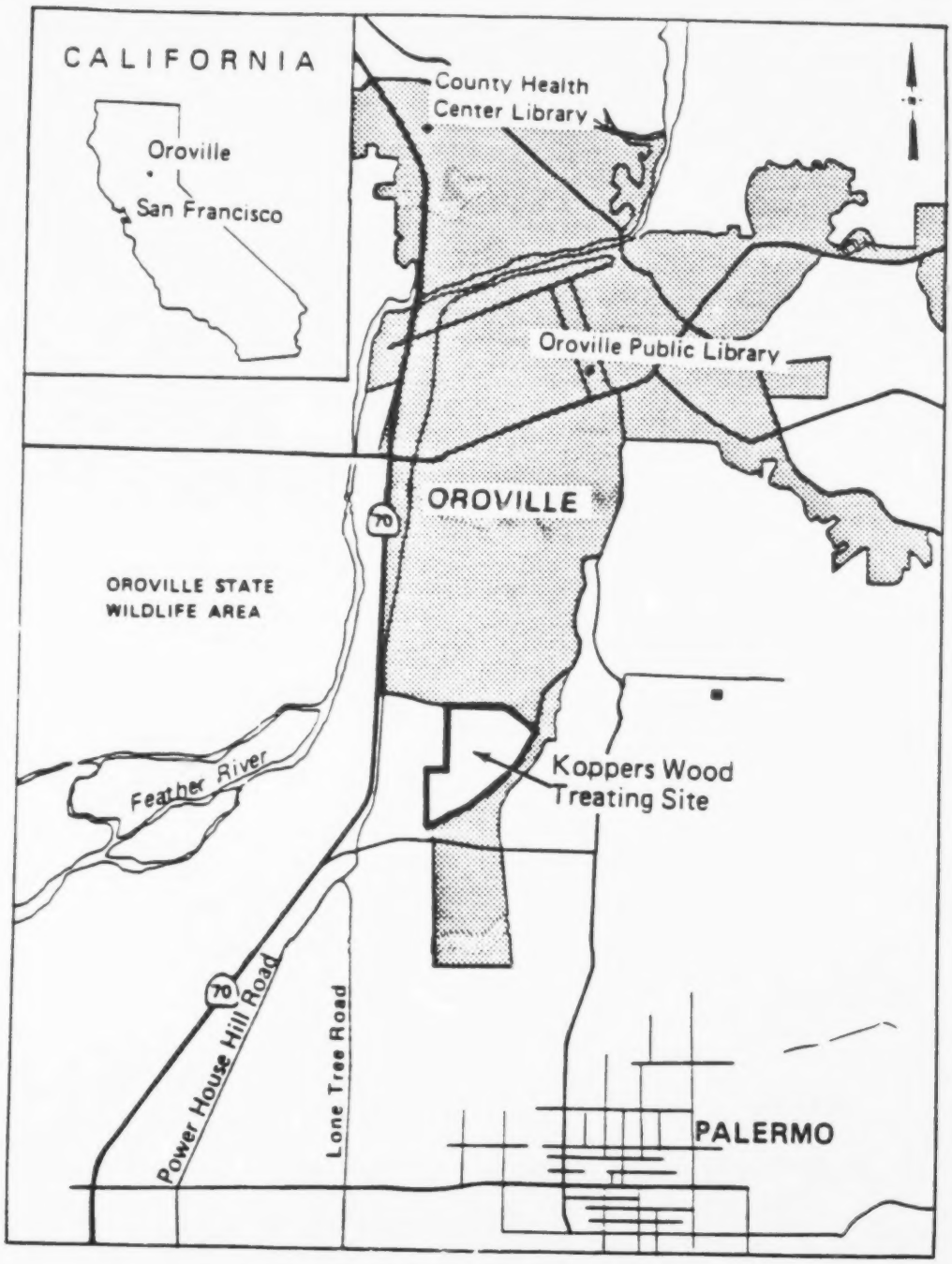

FIGURE 1-1 **SITE LOCATION MAP**

2.0 Site and Enforcement History

During the early 1900's the area around the Koppers site was used for gold mining dredge operations. From approximately 1920 to approximately 1948, Hutchison Lumber Mill was located at the site. From approximately 1948 to 1955, the site was owned and operated by National Wood Treating Company. In 1955, Koppers became the owner and operator of the site, and expanded wood treating operations. Contamination was first documented in onsite ground water in 1971. The contribution of Hutchison Lumber Mill and National Wood Treating Company to the pollution problem at the Koppers site is unknown. Koppers has not identified these other companies as being liable for causing site contamination.

Since 1955 Koppers has operated several wood treating processes at the site. Chemical preservatives including pentachlophenol, creosote, and chromated copper arsenate (CCA) solution, have been applied to wood in pressurized treatment vessels. Treated wood product uses include utility poles, railroad ties, and building foundations.

Wastewater from the creosote and pentachlorophenol wood treating processes were discharged directly to unlined ponds near the western site boundary. (See Figure 1-2, Site Features) One of Koppers' pentachlorophenol treating processes resulted in poles with a layer of pentachlorophenol crystals. From 1963 to 1973, Koppers used a caustic solution to rinse off this excess pentachlorophenol over unlined soil. In 1963 a treatment process using pentachlorophenol exploded, resulting in the death of one Koppers worker. Debris from this fire were buried onsite.

In 1971, pentachlorophenol was detected in onsite ground water. In 1972, this contamination was found in residential wells southwest of the site. In 1973, the California Regional Water Quality Control Board, Central Valley Region (RWQCB) issued an order to Koppers which led to cleanup activities and process changes. Two ground water recovery wells were installed. Contaminated ground water was discharged to spray fields on the site. Pursuant to this 1973 order, contaminated debris from the 1963 fire were sent to an offsite landfill. A waste water treatment process was constructed which led to the discontinuation of direct wastewater discharge to unlined ponds. In 1974, after contaminant levels in offsite wells declined, the RWQCB Order was rescinded.

In 1981, the State of California (RWQCB and Department of Health Services) directed investigations of onsite contamination. The RWQCB issued two orders in 1982 for the cleanup of contaminated soils and ground water.

In September, 1983, the site was proposed for the EPA's Superfund National Priorities List (NPL). In September, 1984 Koppers was finalized on the NPL. Koppers began work on a Remedial

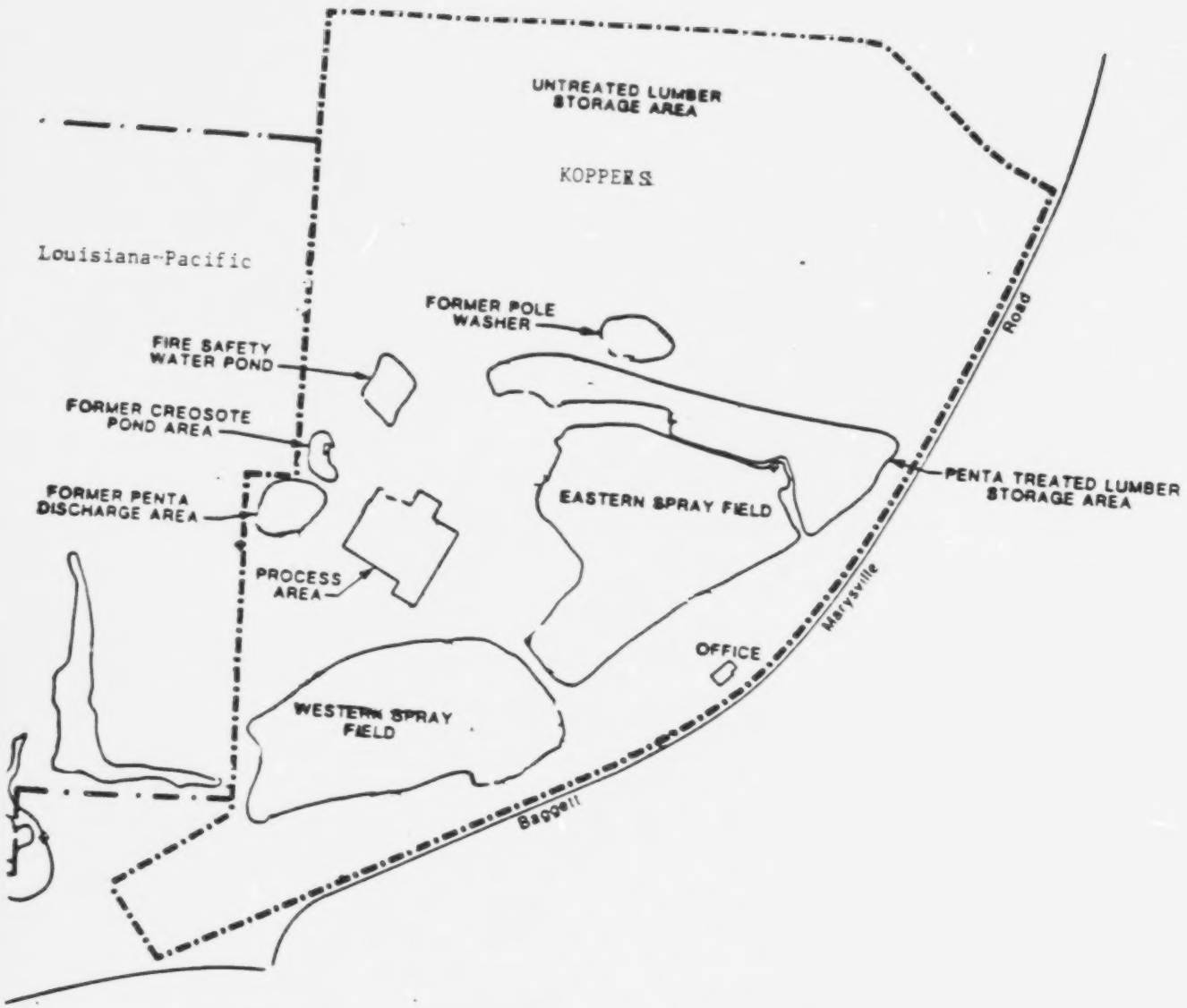

FIGURE 1-2 SITE FEATURES

Investigation/Feasibility Study (RI/FS) work plan in 1984, under the direction of the California Department of Health Services (DHS). In mid-1985, the DHS requested that EPA take the lead on the site. On April 25, 1986, EPA and Koppers agreed to an Administrative Order on Consent for Koppers to conduct the RI/FS.

In December, 1983 contaminated ground water was found in residential wells over one mile south of the Koppers site. In March, 1984 Koppers began supplying bottled water to residents with contaminated wells. In March, 1986 Koppers provided an alternative water supply for domestic uses to residents with contaminated wells, although residents have been charged for water used for irrigation.

On April, 6, 1987 an explosion and fire occurred at one of Koppers' pentachlorophenol wood treating processes. EPA issued a unilateral removal order requiring clean-up of fire debris, and removal and stabilization of surface soils.

Subsequent to the April, 1987 fire, the DHS sampled areas around the Koppers site. In March, 1988, the DHS announced its finding of elevated levels of dioxins in chicken eggs in the area. Further sampling led the DHS to issue an advisory on the use of agricultural products for an area southeast of the Koppers facility. In January, 1989 the DHS requested EPA assistance for its investigation of these dioxin findings. The EPA headquarters office has met with the DHS and is currently working on recommendations on how to address these area-wide dioxin findings. The source of the area-wide trace dioxin contamination has yet to be determined.

In August, 1988, Koppers completed the Remedial Investigation Report. In November, 1988 the EPA completed an Endangerment Assessment on the risks from the Koppers site. The draft Feasibility Study report was completed by Koppers in May, 1989.

On April 28, 1989, the RWQCB adopted Waste Discharge Requirements which place contaminant limits on discharges from waste water treatment and the onsite recovery well.

In 1988, ownership of the Koppers site changed hands. Between June and November, 1988, Beazer Materials and Services, Inc. (Beazer) purchased Koppers Company, Inc. On December 28, 1988, Beazer sold some aspects of the corporation, including the Koppers/Oroville Superfund site, to Koppers Industries, Inc. According to attorneys for Beazer, Beazer has retained responsibilities for CERCLA matters at the Koppers site.

The EPA will be issuing special notice letters later in 1989 to responsible parties at the Koppers site to initiate Remedial Design/Remedial Action negotiations on a Consent Decree for future site work.

Correspondence between EPA and Koppers can be found in the Administrative Record for this site, an index of which is attached to this Record of Decision.

3.0 Community Participation

The EPA has encouraged public participation throughout the RI/FS, and has gone beyond the CERCLA requirements in this area.

In May, 1986, the EPA solicited comments on the RI/FS work plan. Regular community meetings were held on a monthly and bimonthly basis throughout 1986 and 1987. Fact sheets on milestones at the site were sent out to the interested public. RI/FS documents, including the RI Report, Endangerment Assessment, and FS Report, were sent to local libraries and a representative of the major community group.

Input received from the public influenced EPA's oversight of the RI/FS, and the substance of the RI/FS. Sampling events were performed by EPA and required of Koppers after suggestions were made by the public. EPA increased its presence during Koppers' well-drilling activities in order to respond to public input.

The community has had concerns with the Potentially Responsible Party (PRP) performing the RI/FS and has suggested that EPA should be doing this investigation instead of Koppers.

Another concern of the community has been with contamination impacts on ground water, in an area where most people have traditionally used wells for domestic water supply. Koppers had an alternative water supply piped into the area in 1986, but concerns remain about the volume of water provided, and the areal extent of the alternate supply.

A public comment period on the proposed plan was held between May 22, 1989 and June 20, 1989. Public notice was provided in a local newspaper, the Oroville Mercury-Register, prior to the opening of the public comment period. Briefings on the proposed plan were given to representatives of community groups, elected officials, and the press on May 16, 1989. In reporting on these briefings, the press advertised the proposed plan and public comment period. An open house on the proposed plan was held in Oroville on June 1, 1989 to informally explain the plan and discuss it with concerned citizens. A formal public meeting, in accordance with CERCLA section 117(a)(2), was held on June 13, 1989.

EPA has prepared the attached response summary, which provides EPA's responses to comments submitted in writing during the public comment period, and to comments that were not addressed during the June 13 public meeting. A transcript of the June 13 meeting is also attached.

Therefore as described above, public participation requirements for EPA's selection of the remedy in CERCLA sections 113(k)(2)(B)(i-v) and 117(a) were met.

4.0 Scope and Role of Decision

The selected remedial actions address contamination in onsite soils and ground water impacted by Koppers' contamination. These actions are considered an operable unit with EPA's first remedial activities at the Koppers site.

The soils remedy will reduce contamination to health protective levels consistent with potential future residential exposure to these soils. Soils beneath the wood treating process area are not presently being treated as part of these remedial actions. However this remedy stipulates that these soils will be addressed, consistent with the overall remedial objectives for the site, when these soils are accessible.

Ground water will be restored to a condition that will enable its safe use as a public drinking water supply. In 1986, Koppers provided an alternative domestic water supply to residents affected by contaminated ground water. The provision of water was not formalized in a record of decision. This decision document formalizes the provision of an alternative water supply to those affected by the contamination until remedial objectives in ground water are met. The volume of water provided will be sufficient to meet all uses (including irrigation), and to ensure that contaminated domestic wells are not utilized, and that the use of wells that would adversely affect the pump and treat remediation is discontinued.

These selected actions address the documented potential threats from the site. An additional area is currently being investigated and could result in future actions regarding this site. The selected remedies are therefore considered an operable unit for this site.

Trace dioxin contamination has been found in offsite soils and in chicken and eggs. The State of California is investigating the extent of potential problems, and potential sources of this contamination. Since dioxin contamination has been documented onsite at Koppers, it is possible that Koppers is a contributor to the offsite dioxin levels, although there are several potential sources.

Additionally, an investigation of air emissions from Koppers' ongoing wood treating operations is underway by EPA. At this point, it is unclear whether these emissions pose a public

health threat, or whether they would need to be addressed under CERCLA or other statutory authorities. It is possible that future actions will be needed to address these emissions.

5.0 Summary of Site Characteristics

Site characterization activities at the Koppers site have involved sampling and analysis of soil, ground water, surface water, sediment, and airborne particulate matter.

Chemical analyses of soils from the Koppers site revealed the presence of wood treatment formulation chemicals in on-site soils, resulting from past processing and waste management practices at the Koppers site. Wood treatment solutions dripped onto the ground as the treated woods were removed from the process areas and as treated wood was handled. Waste waters from wood treating processes were collected in unlined ponds. In addition, process fires in 1963 and 1987 resulted in releases of pentachlorophenol (PCP) and polychlorinated dibenzodioxins/dibenzofurans (PCDDs/PCDFs) to site soils. Contamination releases to onsite soil from the 1987 fire were addressed by a mitigation program directed by EPA.

Table 5-1 summarizes the results of all soil sampling at the site. PCP was frequently detected, showing elevated concentrations at the process area, the former Cellon blowdown area, the pole washing area, and the areas along the railcar tracks north of the process area. PCP was also detected in two off-site soil samples where contaminated well water was used for irrigation. Polynuclear Aromatic Hydrocarbons (PAHs) were detected on site at elevated concentrations in areas in which creosote was stored or used; for instance, in the vicinity of the former creosote pond and the process area. Phenanthrene, a PAH compound, was detected in one off-site sample from the irrigated property.

PCDD/PCDFs were detected in site soils. The highest levels of PCDDs/PCDFs observed in samples collected by Koppers for the RI/FS were in soils from the Koppers process area, and in the former Cellon blowdown area.

Arsenic, chromium, and copper were used by Koppers in the Copper Chromated Arsenate (CCA) process. Elevated concentrations of all three metals were found at the process area, with elevated levels of arsenic and chromium also detected north and west of the process area where wood treated with these metals was stored.

Ground water in the area occurs in three aquifers. The physical and chemical characteristics of these aquifers have been characterized in the Remedial Investigation. Ground water from the site flows in a generally southerly direction. Contamination originating from the Koppers site was detected in off-site wells

Table 5-1. CONTAMINANTS OF CONCERN, SOIL AND SEDIMENTS, KOPPERS FEATHER RIVER PLANT

Compound	Soil			Sediments[b]		
	Detection Frequency	Geometric Mean[a]	Maximum Concentration	Detection Frequency	Geometric Mean[a]	Maximum Concentration
ORGANICS	(µg/kg)	(µg/kg)	(µg/kg)		(µg/kg)	(µg/kg)
PCP	241/344	480	33,000,000	28/29	98.03	4,000
2,3,4,6-tetrachlorophenol (on-site soil only)	47/123	880	240,000			
PCDDs/PCDFs						
• Tetra Furans (Total)	12/41	0.86	15	3/17	0.94	1.9
• Penta Furans	14/41	9	216	7/17	1.66	24.50
• Hexa Furans	24/41	13	1,360	10/17	6.00	102
• Hepta Furans	28/41	23	5,130	10/17	14.67	305
• Octa Furans	28/41	32	15,800	10/17	21.86	9,920
• Tetra Dioxins (Total)	4/41	0.27	1.9	2/17	1.67	1.70
• Penta Dioxins	10/41	6.2	55	8/17	1.39	12.20
• Hexa Dioxins	19/41	16	958	7/17	10.75	111
• Hepta Dioxins	29/41	47	9,260	14/17	17.03	792
• Octa Dioxins	35/41	83	43,700	15/17	47.49	3,900
PAHs						
• Acenaphthene	11/298	16,000	77,000	---	---	---
• Acenapthylene	8/298	3,600	93,000	---	---	---
• Anthracene	80/298	150	290,000	3/8	185.16	230
• Benzo(a)anthracene	62/298	710	220,000	4/8	168.31	860
• Benzo(b)fluoranthene	103/298	150	140,000	8/8	28.97	940
• Benzo(k)fluoranthene	89/298	120	83,000	4/8	114.72	470
• Benzo(g,h,i)perylene	10/298	320	12,000	3/8	257.49	1,300
• Benzo(a)pyrene	60/298	300	144,000	4/8	222.76	1,800
• Chrysene	73/298	480	500,000	4/8	276.22	1,400
• Dibenzo(a,h)anthracene	4/298	95	400	1/8	1,400	1,400

Table 5-1. CONTAMINANTS OF CONCERN, SOIL AND SEDIMENTS, KOPPERS FEATHER RIVER PLANT (concluded)

Compound	Soil			Sediments[b]		
	Detection Frequency	Geometric Mean[a]	Maximum Concentration	Detection Frequency	Geometric Mean[a]	Maximum Concentration
		(µg/kg)	(µg/kg)		(µg/kg)	(µg/kg)
• Dibenzo(g,h,i)perylene	---	---	---	1/8	38	38
• Dibenzofuran	1/12	64,000	64,000	---	---	---
• Fluoranthene	125/298	660	1,300,000	3/8	621.32	2,600
• Fluorene	41/298	1,900	940,000	1/8	69	69
• Indeno(1,2,3-CD)pyrene	47/298	210	60,000	2/8	320.47	1,300
• Naphthalene	25/298	5,100	1,500,000	---	---	---
• Phenanthrene	134/298	280	2,400,000	2/8	404.10	710
• Pyrene	94/298	1,300	1,200,000	4/8	304.52	2,000
Methylene chloride (on-site soils only)	1/12	200	200			
Xylenes (Total) (on-site soils only)	1/12	91	91			
INORGANICS		(mg/kg)	(mg/kg)		(mg/kg)	(mg/kg)
Arsenic	88/112	12	681	28/29	6.92	36
Boron (on-site soils only)	4/6	10	28	--	--	--
Chromium	114/114	90	1,425	29/29	35.62	120
Copper	112/112	46	1,091	29/29	21.36	130
Nickel (on-site soils only)	17/17	56	105	--	--	--

[a] Geometric mean of positive detects only.
[b] Includes sediments from off-site ponds, down-gradient from Koppers plant.

in 1972. In order to prevent further off-site migration, two recovery wells were installed on the Koppers property to intercept contaminated ground water. At the present time, only one of these wells (RW-2) is still in operation.

Ground water quality has been characterized by sampling throughout the RI/FS, beginning in June, 1986. Data used to assess site risks were collected through December, 1987. Quarterly monitoring of ground water has continued to the present and results from this testing can be found in the Administrative Record. Thirty-nine on-site wells and 105 off-site wells were sampled during the RI efforts. Samples were collected from both monitoring wells and existing private wells. Ground water samples were collected using standard EPA protocol and were analyzed for volatile and semivolatile organics and inorganics.

Chemicals detected in on-site and off-site ground water are listed in Table 5-2, along with the frequency of detection, geometric mean, and maximum concentrations.

PCP was detected with high frequency in both on- and off-site monitoring wells. The highest levels were observed in the former Cellon blowdown discharge area next to the Louisiana-Pacific (L-P) property line. PCP was detected in off-site ground water, up to 2 miles south of the site, in a narrow plume which appears to follow the route of a buried paleovalley.

Isopropyl ether (IPE) has been detected in both on- and off-site wells associated with the PCP plume. PCP and IPE originated from the same wood treatment formulation. The highest IPE contamination was detected in the processing area. IPE was detected in off-site ground water up to approximately 1 mile south of the site.

Polycyclic Aromatic Hydrocarbons (PAHs) have been detected in both on-and off-site ground water. The highest concentrations of PAHs were detected at the location of the former creosote pond and in the process area. Detected off-site values occurred in isolated wells and did not form a distinct plume.

PCDDs/PCDFs are known contaminants of technical PCP and were also formed by combustion of PCP in the 1987 Cellon process fire. Low levels have also been detected in on-site and off-site ground water samples.

Arsenic, boron, and chromium were detected at low levels in a small percentage of on-site ground water samples. Copper, chromium, and arsenic were all detected near the CCA treatment area. These metals have been detected a few times in offsite wells in very low levels that may be attributable to naturally occurring metals.

Table 5-2. CONTAMINANTS OF CONCERN, GROUNDWATER, KOPPERS FEATHER RIVER PLANT

Compound	On-Site Groundwater[b]			Off-Site Groundwater		
	Detection Frequency	Geometric Mean[a]	Maximum Concentration	Detection Frequency	Geometric Mean[a]	Maximum Concentration
ORGANICS		(µg/l)	(µg/l)		(µg/l)	(µg/l)
PCP	111/160	160	44,000	116/372	3.1	680
IPE	21/42	660	9,400	20/107	65	1,300
PCDDs/PCDFs						
• Tetra Dioxins (Total)	1/6	0.00025	0.00025	1/4	0.000012	0.000012
• Penta Dioxins	1/6	0.00038	0.00038	0/4	---	---
• Hexa Dioxins	1/6	0.00012	0.00012	1/4	0.00003	0.0011
• Hepta Dioxins	2/6	0.0009	0.0022	2/4	0.000033	0.0013
• Octa Dioxins	5/6	0.0098	0.022	2/4	0.000067	0.0025
• Tetra Furans (Total)	1/6	0.0014	0.0014	1/2	0.00045	0.00045
• Penta Furans	1/6	0.00082	0.00082	1/4	0.000012	0.000012
• Hexa Furans	1/6	0.00015	0.00015	0/4	---	---
• Hepta Furans	1/6	0.000076	0.000076	2/4	0.000027	0.00095
• Octa Furans	1/6	0.000020	0.000020	0/4	---	---
PAHs						
• Acenaphthene	3/80	300	1,600	1/113	0.10	0.10
• Acenapthylene	2/80	3.9	6	---	---	---
• Anthracene	19/80	0.34	3,900	4/113	0.012	0.097
• Benzo(a)anthracene	4/80	4.52	2,000	1/113	0.0080	0.008
• Benzo(a)pyrene	2/80	390	520	1/113	0.0080	0.008
• Benzo(b)fluoranthene	4/80	1.0	410	3/113	0.0035	0.0045
• Benzo(k)fluoranthene	4/80	0.79	290	---	---	---
• Chrysene	6/80	0.85	1,600	2/113	0.0060	0.006
• Dibenzofuran	3/5	180	970	---	---	---
• Fluoranthene	35/80	0.29	9,700	4/113	0.034	0.23
• Fluorene	24/80	3.25	12,000	2/113	0.088	0.10
• Indeno(1,2,3-CD)pyrene	2/80	89	130	---	---	---
• 2-Methylnaphthalene	3/5	160	2,000	---	---	---

Table 5-2. CONTAMINANTS OF CONCERN, GROUNDWATER, KOPPERS FEATHER RIVER PLANT (concluded)

Compound	On-Site Groundwater[b] Detection Frequency	On-Site Groundwater[b] Geometric Mean[a]	On-Site Groundwater[b] Maximum Concentration	Off-Site Groundwater Detection Frequency	Off-Site Groundwater Geometric Mean[a]	Off-Site Groundwater Maximum Concentration
ORGANICS		(µg/l)	(µg/l)		(µg/l)	(µg/l)
PAHs (continued)						
• Naphthalene	13/80	105	70,000	3/113	0.081	0.18
• Phenanthrene	26/80	1 36	26,000	15/113	0.011	0.51
• Pyrene	30/80	0.29	8,200	---	---	---
Benzene (on-site GW only)	3/7	4.8	19			
Ethyl Benzene (on-site GW only)	3/7	8.7	110			
Methylene Chloride (on-site GW only)	4/7	2.2	4.0			
Toluene (on-site GW only)	2/7	21	150			
Xylenes (Total) (on-site GW only)	4/7	18	410			
INORGANICS		(mg/l)	(mg/l)		(mg/l)	(mg/l)
Arsenic	2/47	0.021	0.022	6/95	0.017	0.027
Barium	2/2	1.2	1.32/2	0.66	0.69	
Boron	34/39	0.57	1.970/86	0.41	6.6	
Chromium (Total)	18/98	0.02	0.095	24/181	0.011	0.1
Copper	6/38	0.066	0.252/25	0.017	0.030	

[a] Geometric mean of positive detects only.
[b] On-site groundwater data presents results from testing of the aquifer designated as the B' Aquifer by Koppers' consultants. Contamination in on-site groundwater was found in this aquifer.

Sediment results are presented in Table 5-1. Surface water results are presented in Table 5-3. PCP was detected in all sediment sample locations and in 17 of 20 surface water sample locations. The highest concentrations were in the ditch between the Koppers and L-P sites, and in a drainage channel immediately south of the Koppers site. PAHs were detected in all sediment samples and at low levels in surface waters south of the Koppers property. The highest PAH levels in sediment samples were detected in the ditch between the Koppers and L-P sites. Arsenic, chromium, and copper were measured in all sediment samples; arsenic, boron, and copper were detected in on-site and off-site surface waters.

Results from sampling of airborne particulate are presented in Table 5-4. Maximum PCP, arsenic, and copper concentrations were detected at the midsite process location. The highest PAHs concentration was reported at the northern wood storage area.

6.0 Summary of Site Risks

The EPA prepared an Endangerment Assessment to document the potential risks associated with the no-action remedial alternative at the Koppers site. This document is included in the Administrative Record.

Wood treating operations and waste water handling at the site have contaminated site soils. Water passing over contaminated soils has led to impacts on surface waters and sediments on the site. Contaminated soil has become airborne due to vehicular traffic and wind erosion. Soil contamination has, in turn, migrated into ground water, which has migrated off-site. The use of contaminated ground water to irrigate offsite soils has led to contaminated offsite soils.

Characterization of these media in the Remedial Investigation led to the documentation of sixteen organic and inorganic contaminants that have been treated as chemicals of concern in the assessment of site risks.

Table 6-1 presents the contaminants of concern in all media. Table 6-2 presents the concentrations (geometric means and maxima) of these contaminants that were detected and used to assess site risks.

PCDDs/PCDFs are contaminants of concern at this site. The concentrations of the various components that make up this group of compounds are combined into one concentration representing 2,3,7,8 Tetrachloro Dibenzo-dioxin, the compound of most concern from a toxicological standpoint. The calculation of this Toxicity Equivalent Factor (TEF) is documented in the Endan-

Table 5-3. CONTAMINANTS OF CONCERN, SURFACE WATER, KOPPERS FEATHER RIVER SITE

Compound	Detection Frequency	Geometric Mean[a]	Maximum Concentration
ORGANICS		µg/l)	(µg/l)
PCP	15/18	8.22	140
IPE	6/15	21.41	50
PCDDs/PCDfs		(ng/l)	(ng/l)
• Tetra Furans (Total)	1/6	0.60	0.60
• Hexa Furans	3/12	5.19	8.52
• Hepta Furans	3/12	13.52	19.85
• Octa Furans	1/12	11.10	11.10
• Hexa Dioxins (Total)	2/6	3.32	3.35
• Hepta Dioxins	3/12	35.30	44.55
• Octa Dioxins	6/12	17.25	96.65
PAHs		(µg/l)	(µg/l)
• Anthracene	2/5	0.03	0.041
• Fluoranthene	1/5	0.10	0.10
• Fluorene	1/5	0.22	0.22
• Phenanthrene	1/5	0.28	0.28
INORGANICS		(mg/l)	(mg/l)
Arsenic	14/31	0.01	0.030
Boron	15/24	0.77	1.10
Chloride	15/32	11.99	71
Chromium	3/31	0.03	0.030
Copper	6/31	0.01	0.030

[a] Geometric mean of positive detects only.

8910175ATt CON-1

Table 5-4. CONTAMINANTS OF CONCERN, AIR, KOPPERS FEATHER RIVER SITE

Compound	Location											
	Crosswind			Downwind			Midsite			Upwind		
	Detection Frequency	Mean[a] ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	Detection Frequency	Mean[a] ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	Detection Frequency	Mean[a] ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	Detection Frequency	Mean[a] ($\mu g/m^3$)	Maximum ($\mu g/m^3$)
• Pentachlorophenol	10/18	1.02E-04	2.04E-04	83/84	1.90E-02	3.44E-01	42/42	3.39E-02	4.20E-01	41/41	9.23E-04	2.53E-02
PAHs												
• Acenaphthene	0/18	ND	ND	2/84	1.98E-02	2.65E-02	0/42	ND	ND	0/41	ND	ND
• Acenaphthylene	0/18	ND	ND	5/84	8.94E-03	1.29E-02	0/42	ND	ND	0/41	ND	ND
• Anthracene	1/18	4.15E-04	4.15E-04	63/84	9.00E-04	1.03E-01	25/42	4.35E-04	2.92E-03	14/41	1.87E-04	1.05E-03
• Benzo(a)anthracene	0/18	ND	ND	21/84	3.51E-04	2.56E-03	14/42	8.96E-04	3.65E-03	6/41	2.22E-04	8.01E-04
• Benzo(a)pyrene	0/18	ND	ND	17/84	4.58E-04	2.53E-03	11/42	8.96E-04	2.73E-03	9/41	2.64E-04	1.19E-03
• Benzo(b)fluoranthene	0/18	ND	ND	68/84	3.24E-04	2.47E-03	40/42	1.15E-03	1.02E-02	36/41	1.53E-04	1.15E-03
• Benzo(k)fluoranthene	0/18	ND	ND	45/84	1.72E-04	1.16E-03	37/42	5.10E-04	5.01E-03	17/41	1.04E-04	5.25E-04
• Benzo(g,h,i)perylene	0/18	ND	ND	9/84	2.06E-03	1.41E-02	10/42	1.21E-03	3.36E-03	8/41	3.68E-04	1.48E-03
• Chrysene	1/18	1.81E-04	1.81E-04	28/84	7.98E-04	8.09E-03	21/42	1.97E-03	1.53E-02	1/41	8.48E-04	8.48E-04
• Fluoranthene	0/18	ND	ND	68/84	1.27E-03	1.53E-02	42/42	3.10E-03	3.27E-02	25/41	2.31E-04	1.06E-03
• Fluorene	1/18	1.10E-04	1.10E-04	4/84	1.50E-03	3.19E-03	3/42	1.28E-03	1.51E-03	2/41	1.52E-03	4.43E-03
• Indeno(1,2,3-CD)pyrene	0/18	ND	ND	29/84	3.86E-04	2.66E-03	14/42	6.79E-04	2.06E-03	15/41	3.62E-04	1.30E-03
• Napthalene	2/18	7.62E-04	7.89E-04	2/84	3.80E-03	3.87E-03	0/42	ND	ND	2/41	3.08E-03	5.81E-03
• Phenanthrene	6/18	1.07E-04	9.74E-04	43/84	1.21E-03	1.83E-02	30/42	1.89E-03	1.69E-02	13/41	3.41E-04	9.56E-04
• Pyrene	0/18	ND	ND	40/84	8.59E-04	1.03E-02	26/42	2.45E-03	2.61E-02	8/41	2.06E-04	5.63E-04
Inorganics												
• Arsenic	0/6	ND	ND	5/12	2.98E-03	5.14E-03	6/6	6.88E-03	2.57E-02	0/6	ND	ND
• Chromium (Total)	16/18	3.87E-02	3.59E-01	83/84	1.95E-02	7.23E-01	41/42	4.78E-02	6.49E-01	37/41	1.36E-02	6.19E-01
• Copper	18/18	1.11E-02	1.95E-02	84/84	9.62E-02	2.18E-01	42/42	1.25E-01	6.54E-01	41/41	5.12E-02	1.08E-01
Total Suspended Particulates	18/18	1.13E+00	3.78E+01	84/84	1.93E+02	7.64E+02	42/42	2.18E+02	7.15E+02	41/41	6.35E+01	1.68E+02

[a] Geometric mean of positive detects only.
ND Not Detected

TABLE 6-1

Contaminants of Concern
In All Media
Koppers Feather River Site

Compound	On-site Soils	Off-site Soils	On-site Groundwater	Off-site Groundwater	Surface Water	Sediments	Air
Pentachlorophenol	X	X	X	X	X	X	X
2,3,4,6-Tetrachlorophenol	X	·	·	·	·	X	X
Isopropyl ether	·	·	X	X	X	·	·
PCDDs/PCDFs	X	·	X	X	X	X	X
PAHs	X	X	X	X	X	X	X
Benzene	·	·	X	·	·	·	·
Ethyl benzene	·	·	X	·	·	·	·
Methylene chloride	X	·	X	·	·	·	·
Toluene	·	·	X	·	·	·	·
Xylenes	X	·	X	·	·	·	·

X - contaminant of concern for this medium.
· - not a contaminant of concern for this medium, for reasons discussed in the text.

TABLE 6-1

(continued)

Compound	On-site Soils	Off-site Soils	On-site Groundwater	Off-site Groundwater	Surface Water	Sediments	Air
Arsenic	X	-	X	X	X	X	X
Barium	-	-	X	X	-	-	-
Boron	X	-	X	X	-	-	X
Chromium	X	-	X	X	X	X	X
Copper	X	-	X	X	X	X	X
Nickel	X	-	-	-	-	-	X

X - contaminant of concern for this medium.

- - not a contaminant of concern for this medium, for reasons discussed in the text.

TABLE 6-2
Concentrations of Contaminants of Concern
Used in Exposure Assessment

Chemical	All Soils		Surface Soils		Unpaved Surface Soils		Off-site Surface Soils (Prince property)	
	Geometric Mean	Maximum	Geometric Mean	Maximum	Geometric Mean	Maximum	Geometric Mean	Maximum
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
PENTACHLOROPHENOL	480	33,000,000	420	33,000,000	290	33,000,000	17	17
TETRACHLOROPHENOL	880	240,000	220	240,000	120	240,000	--	--
PCDDs/PCDFs (TCDD Equivalents)	0.20	84.8	24	84.8	31 (a)	84.8	--	--
PAHs: CARCINOGENIC	2,100	1,150,000	1,900	810,000	1,600	810,000	--	--
PAHs: NON-CARCINOGENIC	93,000	7,880,000	110,000	2,280,000	34,000	2,280,000	8.9	8.9
VOLATILES								
BENZENE	--	--	--	--	--	--	--	--
ETHYLBENZENE	--	--	--	--	--	--	--	--
ISOPROPYL ETHER	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE	200	200	--	--	--	--	--	--
TOLUENE	--	--	--	--	--	--	--	--
XYLENES	91	91	--	--	--	--	--	--
INORGANICS	(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
ARSENIC	12	681	16	681	14	681	--	--
BARIUM	110	178	--	--	--	--	--	--
BORON	10	28	8.0	8.0	8	8	--	--
CHROMIUM (TOTAL)	90	1,425	92	1,425	92	1,425	--	--
COPPER	46	1,091	51	1,100	48	1,091	--	--
NICKEL	56	105	55	90	34	34	--	--

(a) - Two samples of unpaved surface soils with detected PCDDs/PCDFs.

-- - not of concern in this medium, not detected, or monitoring data not available.

ND - Not detected

TABLE 6-2 (continued)

Concentrations of Contaminants of Concern
Used in Exposure Assessment

Chemical	On-site Groundwater		Off-site Groundwater		Air (Midsite)		Sediments Off-site Ponds		Surface Water Off-site Ponds	
	Geometric Mean	Maximum	Geometric Mean	Maximum	Geometric Mean	Maximum	Geometric Mean	Maximum	Geometric Mean	Maximum
	(ug/l)	(ug/l)	(ug/l)	(ug/l)	(ug/m3)		(ug/kg)	(ug/kg)	(ug/l)	(ug/l)
PENTACHLOROPHENOL	160	44,000	3.1	680	1.9E-02	3.4E-01	43	1,400	3.3	92
TETRACHLOROPHENOL	--	--	--	--	--	--	ND	ND	--	--
PCDDs/PCDFs (TCDD Equivalents)	2.5E-06	2.8E-04	4.1E-06	4.1E-06	--	--	2.4E-02	2.7E+00	2.8E-04	2.8E-04
PAHs: CARCINOGENIC	490	5,000	0.026	0.026	5.3E-05	3.3E-04	6,600	7,300	ND	ND
PAHs: NON-CARCINOGENIC	750	135,000	0.33	1.22	8.9E-05	7.2E-04	1,300	1,300	0.6	0.6
VOLATILES										
BENZENE	4.8	19	--	--	--	--	--	--	--	--
ETHYLBENZENE	8.7	110	--	--	--	--	--	--	--	--
ISOPROPYL ETHER	660	9,400	65	1300	--	--	--	--	--	--
METHYLENE CHLORIDE	2.3	4	--	--	--	--	--	--	10	10
TOLUENE	21	150	--	--	--	--	--	--	--	--
XYLENES	18	410	--	--	--	--	--	--	--	--
INORGANICS	(mg/l)	(mg/l)	(mg/l)		(ug/m3)		(mg/kg)	(mg/kg)	(mg/l)	(mg/l)
ARSENIC	0.021	0.022	0.017	0.027	6.8E-03	2.6E-02	8.6	36	0.015	0.030
BARIUM	1.2	1.3	0.660	0.690	--	--	--	--	--	--
BORON	0.57	1.9	0.410	6.6	--	--	--	--	0.71	0.80
CHROMIUM (TOTAL)	0.020	0.095	0.011	0.100	4.8E-02	6.5E-01	32	120	24	30
COPPER	0.066	0.25	0.017	0.030	1.2E-01	6.5E-01	21	130	0.030	0.030
NICKEL	--	--	--	--	--	--	--	--	--	--

-- - not of concern in this medium, not detected, or monitoring data not available.
ND - Not detected

germent Assessment. When the toxicity and remediation of PCDDs/PCDFs are discussed in this Record of Decision, they are given in terms of TEF.

A variety of potential current and future exposure scenarios were evaluated. Table 6-3 presents the six current use scenarios and four future-use scenarios for exposure that were evaluated.

Since alternative water supplies are currently used for both on- and off-site drinking water, the current use scenarios only include indirect exposure to ground water used for irrigation.

Future-use scenarios examined include the potential use of ground water for drinking, and the possible residential use of the site.

Exposure was assessed for both an average case and a maximum plausible case for each exposure scenario. For the average case, geometric mean concentrations are used, together with what are considered to be the most likely exposure conditions. For the maximum plausible case, the highest measured concentrations are generally used, together with high, although plausible, estimates of the range of potential exposure parameters relating to frequency and duration of exposure and quantity of contaminated media contacted.

Since Koppers did not complete ground water modeling for the purposes of the endangerment assessment, it was assumed that ground water contamination would remain constant over the exposure scenarios. EPA consultants who authored the endangerment assessment used standard assumptions for the degree of exposure (i.e. amount of water consumed by an adult, area of skin exposed in direct contact with soils).

The applicable toxicological criteria at the time the endangerment assessment was prepared were used in assessing risks. These criteria are presented in Table 6-4.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$ are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

TABLE 6-3

Scenarios Used for Risk Characterization
Koppers Feather River Site

Medium	Population Exposed	Exposure Route
Current-Use		
Unpaved on-site surface soils	trespassers	ingestion/dermal
Off-site soils	residents	ingestion/dermal
Off-site soils	residents	ingestion of vegetables
Off-site groundwater	residents	ingestion of meat and/or milk
Off-site sediments	resident children	ingestion/dermal
Air	residents downwind	inhalation
Future-Use		
On-site surface soils	potential residents	ingestion/dermal
On-site subsurface soils	construction workers	ingestion/dermal
On-site groundwater	potential residents	ingestion
Off-site groundwater	potential residents	ingestion

TABLE 6-4

HEALTH-BASED CRITERIA FOR ORGANIC CONTAMINANTS OF CONCERN[a]
KOPPERS FEATHER RIVER SITE

Chemical	Risk Reference Dose (mg/kg/day)		Cancer Potency Factor $(mg/kg/day)^{-1}$	
	Oral	Inhalation	Oral	Inhalation
Benzene	--- [b]	---	2.9×10^{-2} [A][c]	2.9×10^{-2} [A]
Ethylbenzene	1×10^{-1}	---	---	---
Isopropyl Ether	2.6×10^{-1}	2.6×10^{-1}	---	---
Methylene Chloride	---	---	7.5×10^{-3} [B2]	---
Pentachlorophenol	3×10^{-2}	---	---	---
2,3,4,6-Tetra-chlorophenol	3×10^{-2}	---	---	---
Polychlorinated dibenzodioxins (PCDDs)[d]	1×10^{-9}	---	1.56×10^{5} [B2]	1.56×10^{5} [B2]
Noncarcinogenic PAHs[e] (naphthalene)	4.1×10^{-1}	---	---	---
Carcinogenic PAHs[e] (benzo[a]pyrene)	---		11.5 [B2]	6.1 [B2]
Toluene	3×10^{-1}	1.5	---	---
Xylenes (mixed)	2.0	4.4×10^{-1}	---	---

[a] Health-based criteria are derived from a number of sources. Sources for the criteria are given in the discussions of the toxic properties of the individual chemicals presented in Section 3.2 of this report.

[b] -- = no criteria have been developed.

[c] EPA Weight of Evidence Classification for the compound by the specific route of exposure. Weight of the evidence classification: Group A = Human Carcinogen; Group B2 = Probable Human Carcinogen based on sufficient evidence from animal studies.

[d] Criteria based on 2,3,7,8-TCDD equivalence.

[e] Carcinogenic PAHs as represented by benzo[a]pyrene, non-carcinogenic PAHs by naphthalene.

TABLE 6-4 (CONTINUED)

HEALTH-BASED CRITERIA FOR INORGANIC CONTAMINANTS OF CONCERN[a]
KOPPERS FEATHER RIVER SITE

Chemical	Risk Reference Dose (mg/kg/day)		Cancer Potency Factor $(mg/kg/day)^{-1}$	
	Oral	Inhalation	Oral	Inhalation
Arsenic	--- [b]	---	1.5 [A][c]	50 [A]
Barium	5.0×10^{-2}	1.4×10^{-4}	---	---
Boron	8.6×10^{-2}	---	---	---
Chromium III	1.0	5.1×10^{-3}	---	---
Chromium VI	5×10^{-3}	---	---	41 [A]
Copper	3.7×10^{-2}	1×10^{-2}	---	---
Nickel	2×10^{-2}	---	---	0.84 [A][e]

[a] Health-based criteria are derived from a number of sources. Sources for the criteria are given in the discussions of the toxic properties of the individual chemicals presented in Section 3.2 of this report.

[b] -- = no criteria have been developed.

[c] EPA Weight of Evidence Classification for the compound by the specific route of exposure. Weight of the evidence classification: Group A = Human Carcinogen; B1 = Probable Human Carcinogen based on limited evidence from human studies and sufficient evidence from animal studies; Group B2 = Probable Human Carcinogen based on sufficient evidence from animal studies.

[e] Value reported is for nickel refinery dust.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

It should be noted that the Koppers endangerment assessment was prepared using an RfD for pentachlorophenol since this was the applicable toxicological criteria available for this chemical at the time the risks were assessed. This chemical will likely be reclassified by EPA as a carcinogen. If this occurs, the CPF that is eventually adopted by EPA will be used in assessing the progress of remediation in the five-year review.

Cancer risks calculated in the endangerment assessment are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose.) By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for guaging the potential significance of multiple contaminant exposures within a single medium or across media.

A summary of potential health risks for various exposure pathways, in term of excess cancer risks, and hazard indices, are presented in Table 6-5.

As table 6-5 illustrates, the highest current potential health risks were concluded to be exposure by trespassers to surface soil ($9x10^{-7}$ average exposure, $2x10^{-4}$ maxium plausible exposure) and inhalation of airborne dusts ($3x10^{-6}$ average exposure, $1x10^{-4}$ maximum plausible exposure). The non-carcinogenic risks from current use exposure did not exceed a hazard index of 1 for any exposure pathway.

TABLE 6-5

Summary of Potential Health Risks
Koppers Feather River Site

Chemical	Noncarcinogenic Hazard Index (CDI:RfD)		Total Upperbound Lifetime Excess Cancer Risks	
	Average Case	Maximum Plausible Case	Average Case	Maximum Plausible Case
CURRENT USE				
1. Exposure of trespassers to surface soil contaminants	<1	<1	9×10^{-7}	2×10^{-4}
2. Exposure of residents to off-site soil contaminants	<1	<1	---	---
3. Ingestion of produce grown in contaminated off-site soils	<1	<1	---	---
4. Ingestion of beef and milk from cows drinking contaminated groundwater				
- beef	<1	<1	6×10^{-7}	4×10^{-5}
- milk	<1	<1	1×10^{-6}	2×10^{-5}
5. Exposures of area children to contaminated sediments	<1	<1	2×10^{-7}	2×10^{-5}
6. Inhalation of contaminanted airborne dusts.	<1	<1	3×10^{-6}	1×10^{-4}
FUTURE USE				
1. Exposure to contaminated soil				
- residents	<1	>1	5×10^{-4}	7×10^{-2}
- workers	<1	>1	8×10^{-8}	8×10^{-3}
2. Use of off-site groundwater as a potable water supply				
- off-site	<1	>1	1×10^{-4}	1×10^{-3}
- on-site	>1	>1	7×10^{-3}	8×10^{-1}

Higher health risks were associated with potential future residential use of the site ($5x10^{-4}$ average exposure, $7x10^{-2}$ maximum plausible exposure), and use of contaminated onsite ground water ($7x10^{-3}$ average exposure, $8x10^{-1}$ maximum plausible exposure). Risks from exposure to non-carcinogens exceeded a hazard index of 1 for several potential future use exposures.

The Endangerment Assessment documents uncertainties in these risk conclusions, which may both over- or underestimate risks. It is recognized that the assumption that ground water contamination will remain the same and not attenuate or biodegrade may overestimate risks, while the assumption that intake over time is constant and representative of the exposed population may underestimate risks.

The Remedial Investigation Report and Endangerment Assessment both looked at potential environmental receptors. The Feather River Wildlife Refuge is located on the western side of the Feather River near the site. Sampling of the Feather River water and sediments did not find site-related contaminants, and thus it can be concluded that the site contamination is not affecting this refuge. Waterfowl and other wildlife frequenting onsite ponds and ditches may be at risk from ingestion and dermal contact with contaminants in surface water and sediments. The RI Report documents that a search of the California Natural Diversity Data Base was performed for threatened or endangered species occurring in regions in which the Koppers site and adjacent areas are located. Although several threatened or endangered flora and fauna were identified as potentially occurring in this area, none have been observed on or directly adjacent to the Koppers site, primarily due to the disturbed, industrial nature of the area.

Therefore, as described above, actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

7.0 Description of Alternatives

Because of the variety of contaminants, and the distinct land use patterns present at the site, alternatives were developed for remediation of four onsite soil units and on and offsite ground water. The size and make-up of these units is summarized in the following:

Unit	Contaminant	Area (Sq. Ft.)	Maximum Depth (Feet)	Volume
S1	PCP	869,300	10	110,000 yd^3
S2	PCP, PAHs	800,000	25	200,000 yd^3
S3	PCP, PAHs, Metals	308,000	1-6	19,400 yd^3
S4	Metals	84,600	5	4000 yd^3
GW (off-site)	PCP, IPE	16.1 x (10^6)		3.01 x (10^8) ft^3
GW (on-site)	PCP, IPE, PAHS, Metals	3.9 x (10^6)		8.4 x (10^7) ft^3

The following discussion presents a brief description of the soil and ground water remedial alternatives that have survived the preliminary screening and been carried through a detailed analysis in the Koppers FS. Preliminary screening can be found in the Koppers Feasibility Study (FS) report. It should be noted that the numerical designations of the alternatives (e.g. S1-3) have been changed from the FS report in attempt to clarify the discussion in this ROD.

7.1 SOIL ALTERNATIVES

A brief description of each of the four soil units precedes the discussion of the alternatives considered in the detailed analysis for that specific soil unit. The estimated areal extent of these soil units is shown on Figure 7-1.

7.1.1 **Soil Unit S1** includes the former pole washer area and areas along the drip track leading to the process area, the areas east and south of the process area, the fire debris site at the eastern side of the Western Spray Field, and the surface soils throughout the treated wood transport areas. The principal chemicals of concern in S1 are PCP and PCDDs/PCDFs. The estimated area of S1 is 869,300 square feet and the estimated total volume of soil is 110,000 cubic yards.

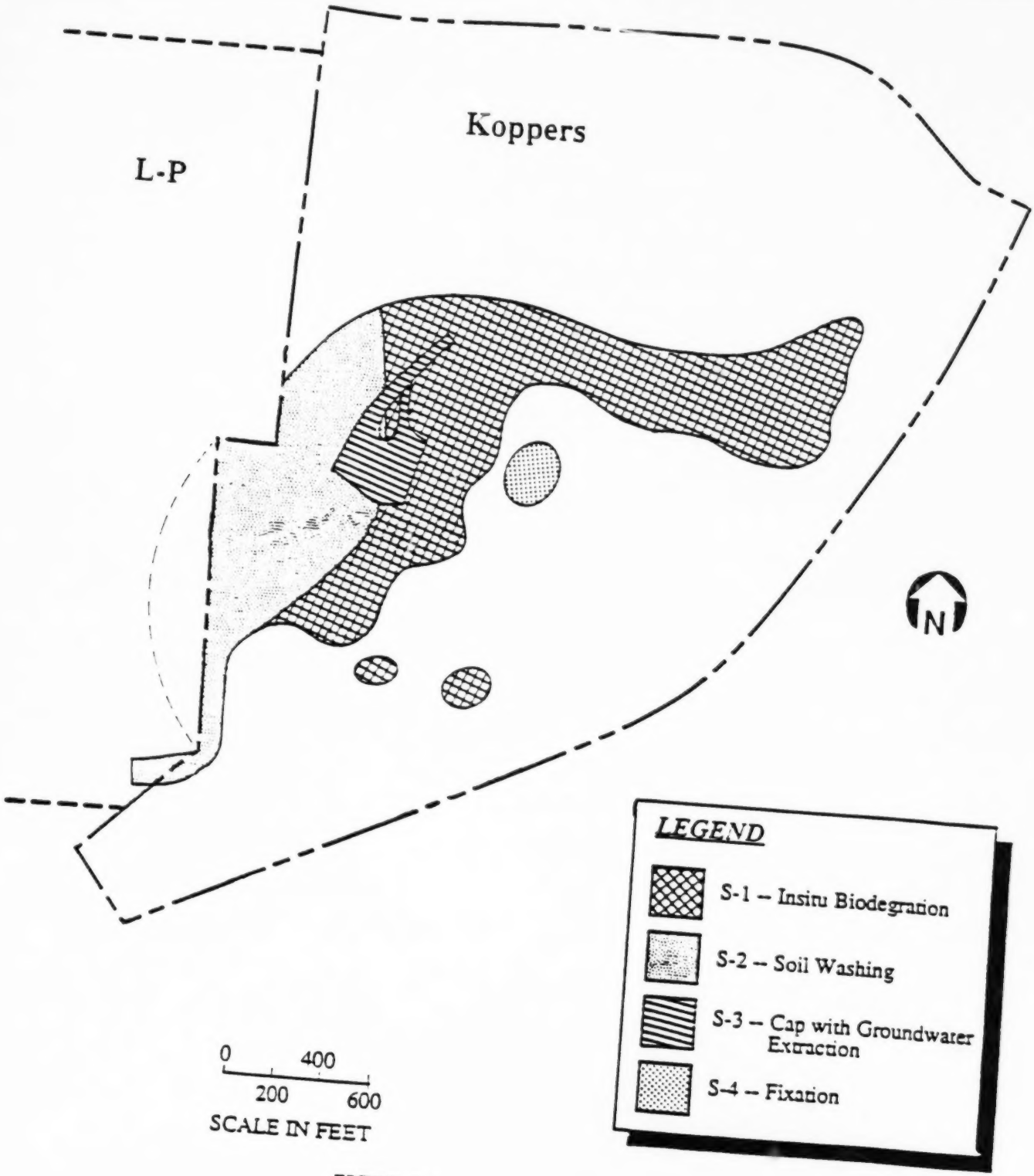

FIGURE 7-1

APPROXIMATE EXTENT OF CONTAMINATED SOILS

7.1.1.1 Alternative S1-1 - Excavation and Soil Washing

Excavation would be accomplished by conventional methods, using a dragline excavation, a backhoe, or both. Soil washing operations would be used to remove contaminants from solids for treatment or reuse. Because of the variability in physical and chemical properties of the contaminated soil, the soil washing unit (or series of units) must be equipped to operate under variable conditions. After contact with the soil, the washing solution is treated and discharged or recirculated through the washing process. The treated soil is then dewatered and placed back into the excavation. The water from dewatering operations will be treated onsite.

7.1.1.2 Alternative S1-2 - In situ biodegradation

Biodegradation of soils is based on the fact that microbes currently exist in the soil that have adapted to, and are using, PCP and other organic chemicals as carbon sources. This biodegradation process is capable of mineralizing the contaminants. In this alternative, the natural system is enhanced to overcome rate limits by adding nutrients and oxygen to the contaminated soil. In alternative S1-2, water with oxygen and nutrients will be applied to surface soil. The water is subsequently withdrawn by shallow extraction wells in the treatment zone, treated, reinoculated with oxygen and nutrients, and returned to the soil. Over time, the combined action of water flushing contaminants from the soil and microbes degrading contaminants will cleanse the soil.

7.1.1.3 Alternative S1-3 - Excavation and Onsite Landfilling

This alternative involves transferring the soil in S1 from its present on-site location into a secure on-site landfill. The landfill would be designed to meet RCRA and California standards for Class 1 landfills.

7.1.1.4 Alternative S1-4 - Capping

This alternative specifies capping the S1 area with a low permeability cap designed to contain contaminants and support site activities. The cap will be constructed by removing 1-2 feet of surface soil, backfilling with clean soil as necessary, providing a layer of clean, crushed rock to support the cap, and installing a low permeability cap, likely to be asphalt.

7.1.2 **Soil Unit S2** includes the former creosote pond and Celon blowdown areas, an area of creosote-contaminated soil along the L-P ditch, and sediments in off-site drainage ditches and ponds southwest of the Koppers site. The soil contained within this unit is estimated to cover 800,000 square feet with a total volume of 200,000 cubic yards.

7.1.2.1 Alternative S2-1 - Excavation and Soil Washing

The excavation will be accomplished by conventional methods, using a dragline excavation, backhoe, or both. Soil washing will be used to remove contaminants from the soil for treatment or reuse. In general, available soil washing techniques incorporate the use of physical separation procedures for particle size screening and then washing of contaminants from the soil into a liquid medium. After contact with the soil, the washing solution is treated and discharged or recirculated through the washing process. The treated soil is dewatered and placed back into the excavation.

7.1.2.2 Alternative S2-2 - Excavation and on-site landfill

This alternative involves transferring the soil in S2 from its present on-site location to a secure on-site landfill. The landfill will be designed to meet RCRA and California standards for Class 1 landfills.

7.1.2.3 Alternative S2-3 - Capping

This alternative specifies capping the S2 area with a low permeability cap designed to contain contaminants and support site activities. The cap will be constructed by removing 1-2 feet of surface soil, backfilling with clean soil as necessary, providing a layer of rock to support the cap, and installing a low permeability cap, likely to be asphalt.

7.1.3 **Soil Unit S3** includes the wood treating process area. The area is characterized by elevated levels of PCP, creosote-related PAHs, and metals. The process area is considered to be a separate unit in order to allow the application of a remedial action that permits continued manufacturing operations. The soil in S3 is estimated to cover 308,000 square feet with a total volume of 19,400 cubic yards. For the soil remedy at Unit S3, only alternatives that could be implemented with continued wood treating operations were considered in the detailed analysis. As part of the selected remedy for this unit, when soil beneath the process area is accessible, the contamination will be remediated in a manner consistent with soil in other units.

7.1.3.1 Alternative S3-1 - No Action

This alternative for the process area and adjacent soil would involve institutional actions, and monitoring. Quarterly monitoring from five specified wells (three existing and two new wells) is included in this alternative.

7.1.3.2 Alternative S3-2 - Capping and Ground water Extraction

This alternative includes capping (with limited excavation) of the process area and ground water pumping. The process area and adjacent soils will be capped with a concrete cap designed to contain contaminants and support manufacturing activities. The cap will be constructed by removing 1 to 3 feet of surface soil, backfilling with soil as necessary, providing a layer of base rock to support the concrete, pouring concrete an estimated 6 inches thick with reinforcing bars, and sealing the concrete seams as required to reduce infiltration. Extraction wells will be installed near the process area to contain contaminated water beneath the facilities. This pumping system will supplement the extraction system alternative proposed for the ground water remediation.

7.1.4 **Soil Unit S4** consists of soil in the areas east and south of the process area where wood treated with metals has been stored. These soils contain arsenic, chromium, and copper. The boundaries of unit S4 are defined by those soils with arsenic and chromium concentrations in excess of local background concentrations. The exact extent of this area will be determined during remedial design. In the FS report, using a 10^{-4} risk level, this unit has been estimated to cover 84,600 square feet with a total volume of 4000 cubic yards.

7.1.4.1 Alternative S4-1 - No Action

This no remedial action alternative for S4 would involve institutional actions, and monitoring. Quarterly monitoring from four specified wells is included in this alternative.

7.1.4.2 Alternative S4-2 - Excavation and Fixation

This alternative proposes to chemically stabilize the S4 soils with an agent designed to immobilize the contaminants. Soils in unit S4 would first be excavated. The soils would be mixed with water; a fixation reagent added; the soil, water, and reagent mixed to facilitate the reaction; and the mixture would be redisposed of on the site and allowed to cure. The fixation reagent may contain, for example, gypsum, blast furnace slag, portland cement, and other minor constituents. Fixation of soil reduces the potential for soil to act as a source of further ground water contamination.

7.1.4.3 **Alternative** S4-3 - Excavation and Offsite Disposal

This alternative proposes excavation and disposal to an off-site landfill. Unlike the other soil units, S4 may be small enough that off-site landfill disposal is an economic and environmentally sound alternative. After excavation, the soil would be loaded onto rail cars or trucks at the site for transportation to a RCRA-permitted landfill meeting EPA's Offsite Policy requirements. Currently the closest such facilities are located in Idaho and Utah.

7.2 GROUND WATER ALTERNATIVES

The off-site and on-site ground water areas of contamination are combined into one unit for the Koppers site. The PCP cleanup level of 2.2 ug/l established an off-site area of 16.1×10^6 square feet, with a mean thickness of 62.8 feet, for a volume of 3×10^8 cubic feet. The on-site area is approximately 3.9×10^6 square feet, with a mean thickness of 71.3 feet, for a volume of 8.4×10^7 cubic feet.

Creosote is present in small volumes of on-site ground water as a free oil phase in the immediate vicinity of the former creosote ponds. Here it appears that free creosote exists as a separate liquid phase in thin pools of on the top of clay lenses that occur within the gravelly aquifer. PAHs, PCP, dioxins/furans, IPE, arsenic, and chromium have been established as contaminants of concern in on-site groundwater.

The estimated areal extent of the ground water contamination is shown on Figure 7-2.

Extraction and treatment of ground water was the only approach that was evaluated in the detailed analysis of alternatives. Containment, and other options, were screened out because they would not adequately protect public health. A variety of treatment methods to remove contamination from ground water were not evaluated in the detailed analysis, since site specific treatability studies have shown that carbon adsorption effectively removes contamination. When water is treated by carbon adsorption, contaminated water is passed through a bed of carbon and the contaminants are physically retained by the carbon particles. Koppers will be demonstrating a modified carbon adsorption system which utilizes a biological process for regeneration of carbon (known as "Bi-far"). If the demonstration of this process proves it is successful, it will be used in the ground water remediation. If this process is not acceptable, another polishing technique utilizing carbon adsorption will be applied.

Institutional actions such as site access and ground water use restrictions will be implemented for all alternatives. These activities include the continued supply of alternative water. The water supply will be expanded as necessary to ensure that contaminated residential wells are not used for any purpose (including irrigation). In addition, during the remedial design, it will be necessary to determine whether the use of other wells will interfere with the extraction of contaminated ground water. If such wells are identified, they will need to be replaced with an alternative water supply.

Ground water extraction will be accomplished by the construction of groundwater recovery wells to be located during remedial design. At the plant site, wells specifically designed

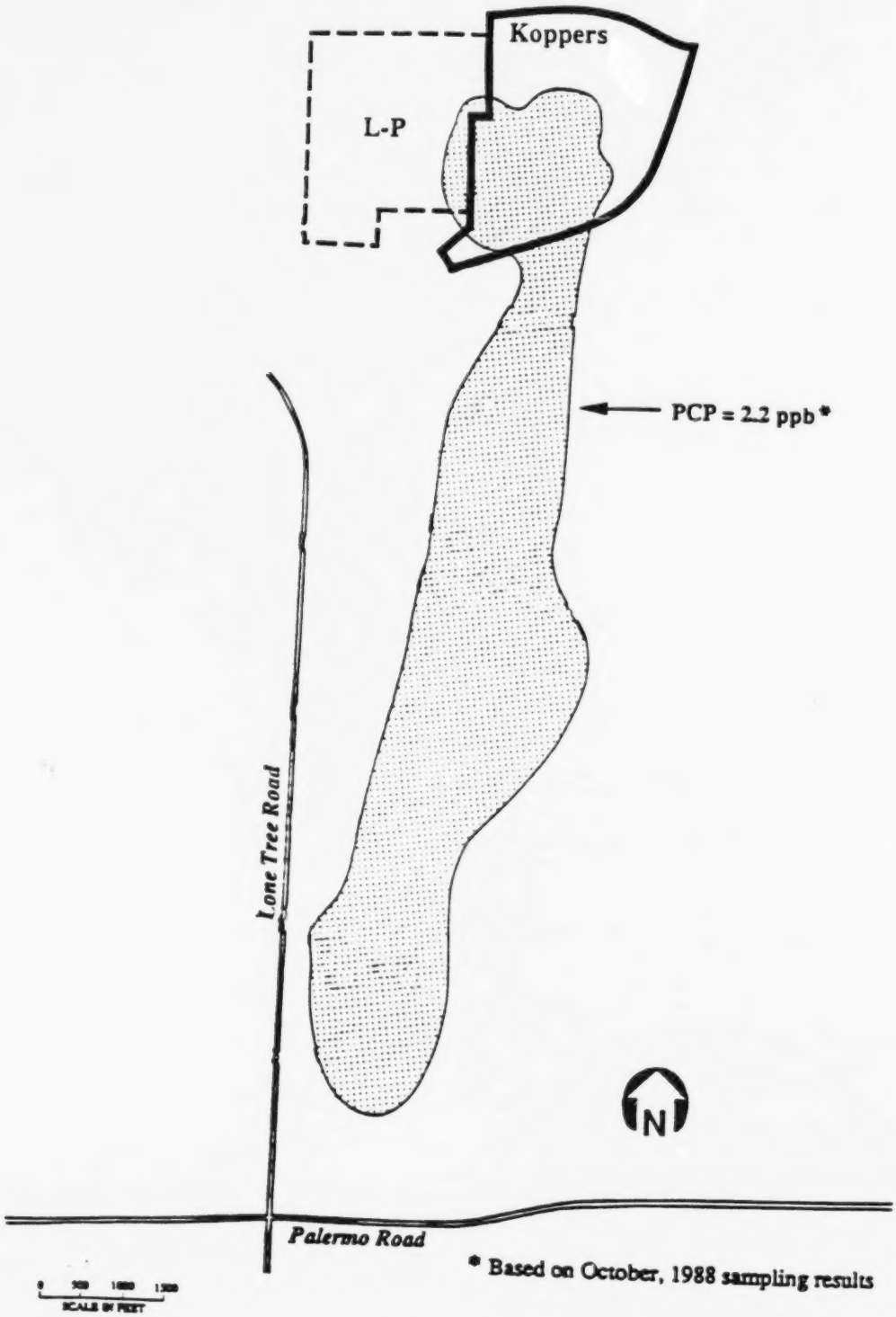

FIGURE 7-2

APPROXIMATE EXTENT OF GROUND WATER CONTAMINATION

to recover free creosote will be placed near the former creosote pond area. Pretreatment of on-site ground water may consist of filtration to remove suspended solids and fine silt, if present. Pretreatment is optional depending on the quality of pumped water. Pretreatment of on-site fluids would also include oil/water separation. Recovered oils may be reused in the manufacturing process. Ground water treatment by carbon adsorption will be required to meet discharge limits.

Two alternatives were evaluated for the discharge of the treated ground water.

7.2.1 Alternative G-1 - Disposal to Surface Water

Under this alternative, treated water from both onsite and offsite extraction wells would be discharged to surface water that would eventually run into the Feather River.

7.2.2 Alternative G-2 - Disposal to Ground Water

Under this alternative, treated water from both onsite and offsite extraction wells would be discharged via recharge wells into the aquifer.

8.0 Applicable and Relevant and Appropriate Requirements (ARARS) and To Be Considered Criteria

Remedial actions selected under CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), must attain levels of cleanup of hazardous substances released into the environment and control of further release which assure protection of human health and the environment. SARA specifies that any selected remedial action must achieve a level or standard of cleanup that meets legally applicable or relevant and appropriate requirements, standards, criteria, or limitations (ARARs).

ARARs are generally separated into three categories: (1) ambient or chemical specific requirements that set health or risk-based concentration limits or ranges for particular chemicals; (2) performance, design, or action-specific requirements that govern particular activities; and (3) location-specific requirements.

The regulatory framework for setting remedial objectives for the cleanup of groundwater and soil at the Koppers site and for the selection of ARARs is based on the beneficial (current or potential) use of local ground water as a drinking water supply. In the Agency's explanation of the implementation of SARA, Federal Register on page 51433 (December 21, 1988), "The goal of EPA's Superfund approach is to return usable ground waters to their beneficial uses within a timeframe that is reasonable."

use of ground water for drinking is considered to be the highest beneficial use and warrants the greatest level of protection and cleanup.

8.1 CHEMICAL-SPECIFIC ARARS

Chemical-specific ARARs for the Koppers site are Federal and State of California drinking water standards. Each is relevant and appropriate to setting cleanup standards at the site. Applicable Federal and State drinking water standards are presented in the first column of Table 8-1.

In addition, maximum allowable concentrations of contaminants in soils are set by State of California standards.

8.1.1 Federal Drinking Water Standards

Potential drinking water standards at the Koppers site include Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), and Secondary Maximum Contaminant Levels (SMCLs). As stated in CERCLA Section 121(d)(1), MCLGs are mentioned as potential cleanup standards when these levels "are relevant and appropriate under the circumstances". Only one MCLG, 220 ug/l for PCP, is potentially appropriate at the Koppers site. This MCLG is considered relevant and appropriate to the Koppers site.

The relevant and appropriate standards to establish groundwater cleanup levels at the site are the Federal Maximum Contaminant Level (MCLs), as established under the Safe Drinking Water Act. EPA bases this decision on the fact that MCLs are in most cases fully protective of human health.

8.1.2 State Drinking Water Standards

California Drinking Water Standards establish enforceable limits for substances that may affect health or aesthetic qualities of water and apply to water delivered to customers. The state's Primary Standards are based on federal National Interim Primary Drinking Water Regulations. Currently, for contaminants found at this site, California has promulgated MCLs for benzene, ethylbenzene, and xylenes.

8.1.3 Ambient Water Quality Criteria

Adjusted EPA Ambient Water Quality Criteria (AWQCs) for drinking water, and aquatic life are potentially ARARs for the Koppers site (Table 8-1, Column 2). For potential carcinogens, AWQCs are set at zero. For these carcinogens, concentrations associated with 10^{-6} excess lifetime cancer risks are also shown (in parentheses) in Column 2 of Table 8-1.

Table 8-1. CHEMICAL-SPECIFIC POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS), KOPPERS FEATHER RIVER SITE

Chemical	Safe Drinking Water Act MCLs[a] (µg/l)	Drinking Water AWQC[d] (µg/l)	Freshwater Aquatic Life AWQC[g]	
			Acute (µg/l)	Chronic (µg/l)
Benzene	5(1)[b]	0(0.67)	--	--
Ethylbenzene	(680)[b]	2,400	--	--
Isopropyl Ether	--	--	--	--
Methylene Chloride	--	--	--	--
Pentachlorophenol	220[c]	1,010	20	13
Tetrachlorophenol	--	1.0	--	--
PAHs				
Carcinogenic	-	0(0.031)	--	--
Noncarcinogenic	--	--	--	--
PCDDs/PCDFs	--	0(0.00000018)[e]	--	--
Toluene	--	15,000	--	--
Xylenes	(1,750)[b]	--	--	--
Formaldehyde	--	--	--	--
Arsenic	50	0(0.25)	360	190
Barium	1,000	--	--	--
Boron	--	750[f]	--	--
Chromium	50	50	1,700(16)[h]	210(11)[h]
Copper	1,000	1,000	18	12
Nickel	--	15	1,400	160

[a] Primary Maximum Contaminant Levels (MCLs), based on health-related considerations and technological and economic feasibility of control, except for copper. For copper, the MCL is an SMCL or Secondary Maximum Contaminant Level based on organoleptic effects. These are ARARs.

[b] Parenthetical values in the MCLs column are State of California maximum contaminant levels. These enforceable limits are ARARs.

[c] EPA-proposed maximum contaminant level goal (MCLG).

[d] Adjusted EPA Ambient Water Quality Criteria (AWQCs) for drinking water only. AWQCs for potential carcinogens are set at zero; values in parentheses are concentrations associated with 10^{-6} excess lifetime cancer risk. Criterion for copper is based on organoleptic considerations.

[e] EPA treats dioxin/furan Toxicity Equivalent Factors (TEFs) as equivalent to 2,3,7,8-TCDD.

[f] Boron AWQC is based on protection of sensitive crops during long-term irrigation.

[g] EPA Ambient Water Quality Criteria for freshwater aquatic life only.

[h] Acute values are 1-hour and chronic are 4-day criteria. For trivalent and hexavalent (parenthetical values) chromium, respectively.

8.1.4 California Total Threshold Limit Concentrations

Concentrations of hazardous waste constituents that may be left in place in soil are regulated by Total Threshold Limit Concentrations (TTLCs) from California Administrative Code Title 22. Chemical specific concentrations have been set for pentachlorophenol (17 ppm), arsenic (500 ppm), chromium (2500 ppm), and 2,3,7,8 Tetrachoro Dibenzodioxin (0.01 ppm).

8.2 ACTION-SPECIFIC ARARS

Ground water extraction and treatment involves pumping, treating, and discharging the treated water to surface water or reinjecting it into the aquifer. The treatment would involve removal of contaminants by pretreatment followed by activated carbon adsorption. Use of carbon adsorption may require consideration of ARARs associated with disposal or regeneration of the carbon. Surface water discharge or reinjection of treated water must meet action-specific ARARs.

Soil remediation alternatives include excavation and treatment, in situ treatment, and excavation followed by on-site or off-site landfill disposal. There are action-specific ARARs corresponding to these options.

8.2.1. Discharge of Treated Effluent to Surface Water

Substantive National Pollutant Discharge Elimination System (NPDES) permit requirements would apply to treated effluent discharging to surface waters. These requirements would primarily be effluent limitations and monitoring requirements. The California Regional Water Quality Control Board (RWQCB) regulates NPDES discharges. Ambient Water Quality Criteria and technology based standards are used by the RWQCB to set NPDES effluent discharge limitations.

Discharge to surface water would also be controlled under the Porter-Cologne Water Quality Control Act regulated by the RWQCB.

8.2.2 Reinjection of Treated Effluent Into Aquifers

If treated ground water is reinjected, regulations governing underground injection may apply. Specifically, the Federal Safe Drinking Water Act requires an Underground Injection Control (UIC) program. In California, the UIC program is administered by the U.S. EPA. For CERCLA cleanups, the UIC program regulates the method and location of the injection. These Federal requirements regarding injection are ARARs for the site.

Federal RCRA requirements and the State's Toxic Injection Well Control Act of 1985 (Cal. Health & Safety Code Section 25159.10 et seq.) are also ARARs for the reinjection of treated ground water.

As in the case of surface discharge, reinjection of treated ground water would be controlled under the Porter-Cologne Water Quality Control Act regulated by the California RWQCB.

8.2.3 Air Emission Standards

Any new source that emits toxic chemicals to the atmosphere at levels determined by the Butte County Air Pollution Control District (BCAPCD) to be appropriate for review must have authorization to construct and a permit to operate from this agency. Although on-site treatment facilities are exempted by CERCLA from the administrative requirements of the permitting process, emission limits and monitoring requirements imposed by the BCAPCD must be met.

8.2.4 Carbon Adsorption

Use of granular activated carbon for remediation of ground water can trigger requirements associated with regeneration or disposal of the spent carbon. If the spent carbon is a listed waste or a characteristic waste under RCRA, then it is regulated as a hazardous waste under RCRA and California's hazardous waste control laws. Disposal of contaminants can trigger RCRA land disposal restrictions. For disposal, the spent carbon would need to be treated to meet Best Demonstrated Available Technology (BDAT) treatment standards. RCRA off-site Subtitle C disposal restrictions would also apply. Regeneration is preferred over disposal.

Regeneration of activated carbon, using the Bi-Far system (a biological process), is considered "recycling" under both Federal and California hazardous waste regulations. Transportation, storage, and generation of hazardous waste for recycling must comply with requirements in RCRA and California hazardous waste control regulations. On-site storage of contaminated carbon may trigger substantive requirements under municipal or county hazardous materials ordinances. If the spent carbon is considered a hazardous waste, construction and monitoring requirements for storage facilities may also apply.

8.2.5 Excavation, Treatment, and Disposal of Soil

Alternatives have been evaluated for remediating contaminated soil by a variety of methods including; (1) excavation and soil washing, (2) in situ bioremediation, (3) on-site landfill, (4) off-site landfill, (5) capping, and (6) excavation and chemical fixation.

Butte County APCD emission limits and monitoring requirements may be ARARs associated with these alternatives.

For the alternatives involving on-site and off-site landfills (items 3 and 6 above), landfill siting and design must be consistent with federal standards described in Code of Federal Regulations 40 CFR Part 264, Subpart N; and state standards described in California Administrative Code (CAC) Title 22, Division 4, Chapter 30, Article 29, and CAC Title 23, Chapter 3, Subchapter 15, Article 3.

In addition, the off-site landfill would be a Class I landfill, in compliance with federal and state law governing hazardous waste disposal off site.

The Koppers fire safety pond and its surroundings is a "wet riparian habitat," and may be impacted by excavation associated with soil washing, on-site landfill, and capping (items 1, 3, and 5 above). If so, requirements to repair or replace these wetlands consistent with EPA wetlands requirements and policies will be met.

Excavation, treatment, and redisposal of soil in the western portion of the Koppers site (Unit S2) is subject to RCRA land disposal restrictions because RCRA K001 wastes will be "placed" (under the RCRA Land Disposal Restrictions) there. The concentrations that cannot be exceeded for the "placement" of this waste under the land disposal restrictions are:

Napthalene	8 mg/kg
PCP	37 mg/kg
Phenanthrene	8 mg/kg
Pyrene	7.3 mg/kg
Toluene	0.14 mg/kg
Xylenes	0.16 mg/kg

Remediation of Unit S4 could potentially be determined to be treatment of hazardous waste as defined by RCRA. Two alternatives for this unit involve "placement" of treated soil (S4-2, S4-3). However, it appears that arsenic and chromium levels are not high enough to qualify as RCRA waste. EP Toxicity tests have not been performed, however they will be done during the Remedial Design to verify that this is not RCRA waste. The RCRA Land Disposal Restrictions are not ARARs for Unit S4 unless the EP Toxicity tests show this to be RCRA waste.

Fixation of soil in Unit S4 (alternative S4-2) would need to meet applicable standards for leachable contamination. These would include the California Soluble Threshold Limit Concentrations (STLC). The STLC for Arsenic is 5 mg/l of leachate and for chromium is 560 mg/l of leachate.

8.3 LOCATION-SPECIFIC ARARS

8.3.1 Fault Zone

The Koppers site is not located within 61 meters (200 feet) of a fault. Therefore, the fault zone requirement of 40 CFR Section 264.18(a) is satisfied.

8.3.2 Floodplain

A hazardous waste treatment facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood. The Koppers site is located in a 100-year floodplain of the Feather River. The requirements of 40 CFR Part 264.18(b) must be met. This means that facilities such as the soil washing unit will have to be designed, constructed, operated, and maintained to prevent washout from a 100-year flood.

8.4 TO BE CONSIDERED CRITERIA

In establishing selected remedial alternatives, EPA considers various procedures, criteria, advisories, and resolutions. These "to be considered" criteria (TBCs) do not carry the weight of ARARs, but are relevant to the cleanup of the site. The following discussion presents selected criteria relevant to the selection of remedial alternatives.

8.4.1 State Criteria for Ground water Cleanup

California's criteria for evaluating drinking water quality and ground water cleanup are advisory Drinking Water Action Levels and advisory Applied Action Levels respectively. These criteria are presented in Table 8-2.

Drinking Water Action Levels are health-based concentration limits set by the Department of Health Services (DHS) to limit public exposure to substances not yet regulated by promulgated standards.

Applied Action Levels (AALs) were developed by DHS for use with the California guidanance in the "Site Mitigation Decision Tree." AALs are guidelines that DHS uses to evaluate the risk a site poses. While the DHS Applied Action Levels are not promulgated standards and are not, therefore, ARARs, they have been taken into consideration in developing cleanup standards for the Koppers site pursuant to the National Contingency Plan (NCP).

Table 8-2. TO BE CONSIDERED (TBC) CRITERIA, KOPPERS FEATHER RIVER SITE

Chemical	California DHS Recommended Drinking Water Action Levels[a] (µg/l)	California DHS Applied Action Levels (AALs)[a] (µg/l)
Benzene	0.70	0.70
Ethylbenzene	680	680
Isopropyl Ether	--	--
Methylene Chloride	40	--
Pentachlorophenol	30[b]	2.2[b]
Tetrachlorophenol	--	--
PAHs		
Carcinogenic	--	0.023[c]
Noncarcinogenic	--	19[d]
PCDDs/PCDFs	--	--
Toluene	100	100
Xylenes	620	620
Formaldehyde	30	--
Arsenic	--	--
Barium	--	--
Boron	--	--
Chromium	--	--
Copper	--	--
Nickel	--	--

a Recommended Drinking Water Action Levels and Applied Action Levels (AALs) by the State of California, Department of Health Services (DHS). These are not ARARs but are termed To Be Considered (TBC) standards by EPA.

b The California Drinking Water Action Level for pentachlorophenol is 30 µg/l based on noncarcinogenic effects; the California Applied Action Level (AAL) is 2.2 µg/l based on 10^{-6} excess lifetime cancer risk.

c AAL for benzo(A)pyrene only, the most carcinogenic of the PAHs.

d The California Applied Action Level for noncarcinogenic PAHs applies to the sum of 8 PAHs.

8.4.2 California Resolution 68-16

Resolution 68-16 is California's "Statement of Policy With Respect to Maintaining High Quality of Waters in California". EPA regards Resolution 68-16 as criteria to establish ground water cleanup levels. The policy requires maintenance of existing water quality unless it is demonstrated that a change will benefit the people of the state, will not unreasonably affect beneficial uses of the water, and will not result in water quality less than prescribed by other state policies.

A beneficial use of the ground water in the aquifer system is drinking water. Establishing a cleanup level which maintains this beneficial use should attain the requirements of Resolution 68-16.

8.4.3 Centers for Disease Control Dioxin Advisories

The Centers for Disease Control (CDC) have advised EPA on setting cleanup standards for Superfund sites with dioxins in soils. Soils on sites that are currently or potential a residential area have been cleaned up to 1 ug/l. The CDC has also advised that industrial exposure should be limited to soils less than 5-7 ug/l. No advisory level has been developed for agricultural land usage, but current indication is that the level may be less than that for residential or industrial land use.

9.0 Summary of Comparative Analysis of Alternatives

Twelve soil alternatives and two ground water alternatives were evaluated and compared for the Koppers site. Each of the alternatives were evaluated with respect to EPA's nine evaluation criteria.

1) Overall protection of human health and the environment,
2) Compliance with ARARs,
3) Short term effectiveness in protecting human health and the environment,
4) Long term effectiveness and permanence in protecting human health and the environment,
5) Reduction of toxicity, mobility, and volume of contaminants by treatment,
6) Technical and administrative feasibility of implementation,
7) Capital and operation and maintenance costs,
8) Community Acceptance,
9) State Acceptance.

A summary of the evaluation of alternatives with respect to these criteria is presented in Tables 9-1 to 9-5. Since comments on each alternative were not received from the State of California or the community, the last two criteria are not included in the tables. A general discussion of state and community acceptance follows. A full documentation of all state and community input is provided in the response summary.

A brief discussion of the comparison of alternatives follows the sections on state and community acceptance.

9.1 State Acceptance

The State of California supports the treatment and disposal options proposed by EPA, and has the following concerns or suggestions regarding the selected remedies:

- The cleanup level for dioxins/furans in soil should be set at the 10^{-6} cancer risk level (30 ppt).

- The cleanup level for PCP in ground water should be lower than the state action level of 2.2 ppb to account for other carcinogens.

The majority of the comments raised by the state are relevant to the Consent Decree for the Remedial Design/Remedial Actions, or the details of the RD/RA. These concerns will be saved for consideration at the appropriate time.

9.2 Community Acceptance

Except for one letter, all community comments were provided during a public hearing on the proposed plan. Unified comments on the proposed plan were not provided by any community group as a whole. The following concerns from individuals were raised:

- Cleanup levels should not be greater than background.

- Soil fixation should not be used since it does not remove contamination.

Several community comments also dealt with the implementation of the remedial action and can not be definitively addressed at this time. These will be considered at the appropriate time.

9.3 Comparative Analysis of Alternatives for Unit S1

The alternatives evaluated for unit S1 are excavation and soil washing (S1-1), in situ biodegradation (S1-2), excavation and onsite landfilling (S1-3), and limited excavation and capping (S1-4). All alternatives are evaluated in Table 9-1.

Alternatives S1-3, and S1-4 do not provide adequate overall protection of human health and the environment, or comply with ARARs. S1-4 has problems in long-term effectiveness, since it will not achieve remedial objectives. Neither S1-3 nor S1-4 reduces toxicity, mobility and volume by treatment.

Both S1-1 and S1-2, are protective, would comply with ARARs, and involve treatment to reduce toxicity, mobility and volume of contamination. In comparing alternatives S1-1 and S1-2, the major differences are in short-term effectiveness and cost. The excavation associated with S1-1 would require extensive dust control measures to prevent airborne contaminant migration, that are not necessary with the insitu treatment in S1-2. Costs of S1-1 exceed those of S1-2 by nearly 50%

9.4 Comparative Analysis of Alternatives for Unit S2

The alternatives evaluated for Unit S2 are excavation and soil washing (S2-1), excavation and onsite landfilling (S2-2), and limited excavation and capping (S2-3).

The comparative analysis in Table 9-2 shows that alternative S2-1 provides superior protection of public health and the environment and compliance with ARARs. Alternative S2-1 is also the only alternative for this unit that will reduce toxicity, mobility and volume by treatment.

9.5 Comparative Analysis of Alternatives for Unit S3

The alternatives evaluated for Unit S3 are no action (S3-1), and limited excavation, with capping and containment of ground water contamination by the installation of extraction wells (S3-2). These alternatives are evaluated in Table 9-3.

Alternative S3-2 provides protection of human health and the environment, while alternative S3-1 does not. It is important to note that the actions evaluated for unit S3 are not intended as permanent remedies for these soils. These soils will be remediated in a manner consistent with other site soils when they are accessible.

9.6 Comparative Analysis of Alternatives for Unit S4

The alternatives evaluated for Unit S4 are no action (S4-1), excavation and chemical fixation (S4-2), and excavation and off-site disposal (S4-3). The evaluation of these alternatives is presented in Table 9-4.

Both S4-2, and S4-3 are superior to S4-1 for their protectiveness of public health and the environment and compliance with ARARs. S4-2 has advantages over S4-3 in that it reduces toxicity and mobility through treatment, and is more cost effective than S4-3.

9.7 Comparative Analysis of Alternatives for Ground Water

The alternatives for remediation of ground water both include extraction and treatment of contaminated ground water by carbon adsorption. Alternative G1 involves disposal of treated ground water by discharge to surface water, and Alternative G2 involves disposal of treated ground water back to the ground water. The comparison of these alternatives is presented in Table 9-5.

In comparing these alternatives differences appear in overall protection of human health and short-term effectiveness. The reinjection of water in G2 could also be used for hydraulic control to prevent contamination from migrating into now uncontaminated areas. This provides added protection of public health. Reinjection can also facilitate the removal of contamination by flushing contaminants from the aquifer. This may result in reaching remedial objectives quicker, thus improving short-term effectiveness.

Table 9-1. COMPARATIVE ANALYSIS OF ALTERNATIVES, SOIL UNIT S1

Alternative #:	S1-1	S1-2	S1-3	S1-4
Description of Alternatives	Excavate and wash 110,000 cu. yd. contaminated soil, backfill 110,000 cu. yd. treated soil.	In situ soil biodegradation utilizing soil application of enriched water and water treatment system.	Excavate 110,000 cu. yd. contaminated soil, construct RCRA Class 1 landfill on site, backfill 110,000 cu. yd. soil.	Excavate to limited depth, grade and pave 869,300 sq. ft. of soil to establish a low permeability cap.
Overall Protection of Human Health & Environment	Protection achieved by significant reduction of PCP and other contaminants in S1 soils.	Protection achieved by significant reduction of PCP and other contaminants in S1 soils.	Protection achieved by containing PCP and other contaminants in a secure landfill.	Limited protection achieved by containing PCP and other contaminants beneath a low permeability cap. Likely adverse impact on meeting groundwater remedial objectives.
Compliance with ARARs	The California TTLC standards for arsenic, chromium, and PCP are expected to be met. RCRA Land Disposal Restrictions compliance likely to be achieved.	The California TTLC standards for arsenic, chromium, and PCP are expected to be met.	Landfill siting and design must be consistent with federal RCRA and State Title 22 standards. RCRA Land Disposal Restrictions compliance not likely to be achieved. Excavated soil will not likely meet RCRA Land Disposal Restrictions.	California TTLCs cannot be met without deep excavation in addition to the capping.
Short-Term Effectiveness	Excavation over a large area will require dust control measures. The time required to meet remedial response objectives is estimated to be 10 to 15 years.	A localized rise in the water table, change in soil chemistry, or microbial population may result from applications of water and nutrients to the soil. The time required for meeting remedial response objectives is estimated to be 20 years.	Excavation will require dust control measures. The time required to complete the landfill is estimated to be 1 to 3 years. Federal and state approval is the critical time factor.	Limited excavation and grading will require dust control measures. The time required to install the cap is estimated to be 1 to 2 years.

Table 9-1. COMPARATIVE ANALYSIS OF ALTERNATIVES, SOIL UNIT S1 (continued)

Alternative #:	S1-1	S1-2	S1-3	S1-4
Long-Term Effectiveness	Soil washing removes soil as a source of further groundwater contamination. Operation and maintenance of the soil washing equipment is complex but manageable. Controls to prevent washwater spills will enhance reliability. Washwater treated on-site. Long-term effectiveness will be further evaluated during design in treatability studies.	In situ biodegradation will eliminate contaminated soil as a source of further groundwater contamination. Reliablity enhanced by controls to prevent water spills and shut down processing in the event of operational failures. Long-term effectiveness will be further evaluated during design in treatability studies.	Disposal to an on-site secure landfill will eliminate the contaminated soil as a source of further groundwater contamination. Long-term management, operation, and maintenance is routine. Landfill containment is a proven technology for long-term management of solid waste. Monitoring wells and leachate monitoring will enhance reliability.	Containment of soil reduces risks of further surface water, groundwater, and airborne dust contamination. Capping is a proven technology for reducing management requirements of contaminated soil. Occasional maintenance and replacement of portions of the asphalt may be required. Likely adverse impact on groundwater remedial objectives.
Reduction of Toxicity, Mobility, and Volume Through Treatment	Combined with treatment of washwater, soil washing is effective in reducing toxicity, mobility, and volume (TMV) of PCP, the major contaminant of S1.	Initial increase in mobility of PCP to enable biological processes to act on the contaminant. Groundwater extraction wells designed to confine groundwater to soils involved in biodegradation system. Permanent reduction in TMV.	No reduction of TMV through treatment.	No reduction of TMV through treatment.
Implementability	Performance can be monitored by chemical analysis of soil and washwater; ready availability of equipment and specialists, and storage/disposal services for residuals.	Technical feasibility promising. It is possible that the subsurface environment may present difficulties not identified with currently available soil/groundwater data. System performance can be monitored. System components readily available.	Technical feasibility of this proven technology is promising. Groundwater and leachate monitoring system will insure performance of landfill.	Readily implementable. Asphalt material and installation contractors are available locally.

Table 9-1. COMPARATIVE ANALYSIS OF ALTERNATIVES, SOIL UNIT S1 (concluded)

Alternative #:	S1-1	S1-2	S1-3	S1-4
Cost				
Capital	$7.1 million	$4.5 million	$2.23 million	$8.35 million
Net Present Worth	$17.1 million	$12.2 million	$6.50 million	$8.50 million

Table 9-2. COMPARATIVE ANALYSIS OF ALTERNATIVES, SOIL UNIT S-2

Alternative #:	S2-1	S2-2	S2-3
Description of Alternatives	Excavate up to 200,000 cu. yd. contaminated soil, wash soil and treat washwater, backfill and grade 200,000 cu. yd. soil.	Excavate 200,000 cu. yd. soil, backfill into RCRA Class 1 on-site landfill.	Excavate to limited depth, grade and pave 800,000 sq. ft. of soil to establish a low permeability cap.
Overall Protection of Human Health & Environment	Protection achieved by significant reduction of creosote and other contaminants in S2 soils. Long-term risks to human health reduced, environmental protection enhanced.	Protection achieved by containing creosote and other contaminants in a secure landfill. Landfill will reduce the mobility of the contaminants, thereby reducing long-term risks to humans and enhancing environmental protection.	Limited protection achieved by containing creosote and other contaminants beneath a low permeability cap. Likely adverse impact on meeting groundwater remedial objectives.
Compliance with ARARs	Soil treatment process may be considered a hazardous waste treatment process. If so, the applicable TTLC standards and RCRA LDRs are expected to be met.	Will not meet the RCRA land disposal restrictions.	Capping may not be sufficient by itself to protect groundwater. Excavated, untreated soil will not meet RCRA Land Disposal Restrictions. Capping without deep excavation will not meet California TTLC standards.
Short-Term Effectiveness	Potential risk from airborne dust will need to be mitigated. Time required to complete the landfill is estimated to be 10 to 15 years.	Potential risk from airborne dust will need to be mitigated. Time required to complete the landfill is estimated to be 1 to 3 years.	Potential risk from airborne dust will need to be mitigated. Time required to complete construction of a cap is estimated to be 1 to 2 years.

Table 9-2. COMPARATIVE ANALYSIS OF ALTERNATIVES, SOIL UNIT S-2 (concluded)

Alternative #:	S2-1	S2-2	S2-3
Long-Term Effectiveness	Soil washing will reduce long-term risk of further groundwater contamination. Equipment operation and maintenance is complex but manageable. The system will include controls to prevent washwater spills and shut down processing in the event of failures. Washwater will be treated onsite.	Disposal to an on-site secure landfill provides a method to eliminate soil as a source of further groundwater contamination. Landfill containment is a proven technology. Clay liners, monitoring wells, and leachate control systems provide a highly reliable containment system.	Containment reduces long-term risk of further airborne dust contamination, and surface water infiltration to contaminated soil. Capping is a proven technology for reducing management requirements of contaminated soil. Does not meet remedial objectives due to continued leaching of soil contaminants into groundwater.
Reduction of Toxicity, Mobility, and Volume Through Treatment	Contaminants are amenable to soil washing and are irreversibly destroyed by microbial action of washwater treatment. Volume, mobility, and toxicity of creosote in soil reduced.	No reduction of TMV through treatment.	No reduction of TMV through treatment.
Implementability	Readily implementable. Viscosity of creosote may present special technical problems that can be resolved.	Readily implementable. Landfill performance will be monitored by chemical analysis of leachate and nearby groundwater.	Readily implementable. Asphalt material and installation contractors are available locally. Low probability that technical problems will involve schedule delays.
Cost			
Capital	$7.1 million	$2.63 million	$7.7 million
Net Present Worth	$14.6 million	$10.20 million	$8.0 million

Table 9-3. COMPARATIVE ANALYSIS OF ALTERNATIVES, SOIL UNIT S3

Alternative #:	S3-1	S3-2
Description of Alternatives	No remedial action. Only institutional actions and groundwater monitoring will be performed under this alternative.	Excavate, grade and cap with concrete 308,000 sq. ft. of the process area and drip track, drill two extraction wells for groundwater pumping to insure containment of contaminated water beneath the facilities. Concrete cap to contain contaminants and support manufacturing activities.
Overall Protection of Human Health & Environment	Not protective, but it will contribute in combination with actions taken at other units.	Protectiveness achieved by containing contaminants beneath impermeable cap and by groundwater pumping.
Compliance with ARARs	Does not comply.	Capping by itself is insufficient to protect groundwater. Combined with proposed pump and treat system, however, capping will contribute to compliance. Capping without significant excavation will not achieve California TTLCs for arsenic, chromium, or PCP.
Short-Term Effectiveness	No potential health risks or environmental impacts through remediation activities. Won't meet remedial objectives.	Potential risks from airborne dust contamination will need to be mitigated. Time required to implement remedy is estimated to be 1 to 2 years.
Long-Term Effectiveness	Monitoring wells to detect contamination from the process area are reliable tools. This alternative will not meet remedial objectives.	Containment can reduce soil as a source of further groundwater contamination. Adequate hydraulic control of groundwater beneath the process area will be provided by extraction wells. Capping is a proven technology for reducing management requirements of contaminated soil.
Reduction of Toxicity, Mobility, and Volume Through Treatment	No reduction of TMV through treatment.	Mobility of soil contaminants will be reduced by groundwater pumping and treatment.

Table 9-3. COMPARATIVE ANALYSIS OF ALTERNATIVES, SOIL UNIT S3 (concluded)

Alternative #:	S3-1	S3-2
Implementability	Technically and administratively feasible.	Technically feasible. Concrete material and installation contractors available locally. Performance can be monitored by chemical analysis of nearby monitoring wells.
Cost		
Capital	$63,250	$978,000
Net Present Worth	$340,000	$1.2 million

Table 9-4. COMPARATIVE ANALYSIS OF ALTERNATIVES, SOIL UNIT S4

Alternative #:	S4-1	S4-2	S4-3
Description of Alternatives	No remedial action. Soil sampling and groundwater monitoring are the only activities performed under this alternative.	Chemically fixate 4,000 cu. yd. soil to contain contaminants.	Excavate 4,000 cu. yd. contaminated soil, backfill 4,000 cu. yd. soil, grade 84,600 sq. ft. soil. Transport and dispose off site 4,000 cu. yd. contaminated soil.
Overall Protection of Human Health & Environment	Not protective.	Protection achieved by immobilizing arsenic and chromium.	Protectiveness achieved by removing contaminated soil to an off-site secure Class 1 landfill.
Compliance with ARARs	This alternative will not meet the California TTLC ARAR.	This alternative is expected to meet the California TTLCs for arsenic and chromium leachate.	This alternative is expected to meet ARARs by removing contamination.
Short-Term Effectiveness	No potential health risks or environmental impacts through remediation activities. This alternative will not meet remedial objectives.	Potential risks from airborne dust contamination will need to be mitigated. Time required to meet remedial action objectives is estimated to be 1 to 2 years.	Potential risks from airborne dust contamination will need to be mitigated. Time required to meet remedial response objectives is estimated to be 1 to 2 years.

Table 9-4. COMPARATIVE ANALYSIS OF ALTERNATIVES, SOIL UNIT S4 (concluded)

Alternative #:	S4-1	S4-2	S4-3
Long-Term Effectiveness	Monitoring wells to detect contamination are reliable tools. Access restrictions can reliably reduce unintentional trespass.	Fixation reduces the potential for soil to contaminate groundwater and, therefore, reduces the long-term risk of further groundwater contamination. The utility of the fixation method for arsenic and chromium must be tested during remedial design. Soils are expected to remain fixed over the long term with little required maintenance.	Disposal to a secure landfill eliminates contaminated soil as a source of further groundwater contamination. Landfill containment is a proven technology for long-term management of solid waste. Long-term management is left to the disposal vendor, who is required by RCRA to perform long-term monitoring and maintenance.
Reduction of Toxicity, Mobility, and Volume Through Treatment	No reduction of TMV through treatment.	Fixation reduces the toxicity and mobility of contaminants.	No reduction of TMV through treatment.
Implementability	Readily implementable.	Readily implementable; the probability that technical problems will result in schedule delays is low.	Readily implementable.
Cost			
Capital	$12,500	$500,000	$0
Net Present Worth	$289,000	$1.0 million	$1.7 million

Table 9-5. COMPARATIVE ANALYSIS OF ALTERNATIVES, GROUNDWATER UNIT

Alternative #:	G1	G2
Description of Alternatives	Construct groundwater extraction wells and carbon treatment facility, extract and treat contaminated groundwater, discharge treated water to surface water. Pre-treatment required for on-site groundwater to remove suspended solids and oils. Proposed biological treatment of contaminated carbon filters.	Same as G1 except that treated water discharged to recharge wells.
Overall Protection of Human Health and Environment	Implementation of extraction and treatment systems will reduce the mobility, volume, and toxicity of contaminants, resulting in reduction of potential health risks and increased protection of the environment.	Same as G1; recharge of treated groundwater will help control further migration of contamination.
Compliance with ARARs	System designed to comply with contaminant-specific ARARs specified in Koppers EA and Proposed Plan. RWQCB discharge permit required.	Same as G1; ARARs for underground injection will need to be met.
Short-Term Effectiveness	Clean-up risk will be controlled. The time required to meet remedial response objectives is estimated to be 20 to 30 years.	Same as G1; recharge of treated groundwater will result in more expeditious achievement of remedial objectives.
Long-Term Effectiveness	Likelihood that performance specifications will be achieved is high. Technical components of the system are simple and readily available. Acceptability of residuals for off-site disposal is not anticipated to be difficult.	Same as G1.
Reduction of Toxicity, Mobility, and Volume Through Treatment	PCP and other contaminants removed by treatment process. Residuals may be treated on site in process to be studied during remedial design. Volume, chemical characteristics, and proper disposal of residuals will be determined during remedial design.	Same as G1.
Implementability	Technical feasibility is promising. Surface water discharge subject to RWQCB discharge requirements. RWQCB nondegradation requirements in effect.	Same as G1. RWQCB nondegradation policy also applies to groundwater recharge.

Table 9-5. COMPARATIVE ANALYSIS OF ALTERNATIVES, GROUNDWATER UNIT (concluded)

Alternative #:	G1	G2
Cost		
Capital	$22.6 million	$23.1 million
Net Present Worth	$48.6 million	$48.7 million

10.0 Selected Remedy

10.1 Selected Soil Remedies

The soil cleanup goals for the major contaminants at the Koppers site are 17 ppm for PCP, 30 ppt for dioxins/furans, background for arsenic and chromium, and 0.19 ppm for carcinogenic PAHs. (See Table 10-1) Soil cleanup goals were set to meet 10^{-6} risk targets for total exposure to carcinogens under a potential future residential scenario, or more stringent available state standards.

10.1.1 **Unit S1 - In situ Biodegration**

The selected remedial action for soil area S1 is in situ biodegradation. Approximately 110,000 cubic yards of soil contain contaminants in concentrations greater than the site remediation goals. The goals especially applicable to this area are 17 ppm pentachlorophenol and 30 ppt dioxins/furans. Treatability study work provided by Koppers from other sites has shown promising reductions in PCP using this approach. Site specific treatability studies will be performed during design to develop all operating parameters. Attention will be given to the most effective approach to be used for application of the enriched water to the soil. Attention will be given to preventing any air contaminant migration during the application of water. During implementation of this action performance will be monitored by analyses of soil and water pumped from extraction wells.

All costs presented in this ROD are present worth costs.

It is estimated that remedial objectives for this unit will be achieved in approximately 20 years. Total capital costs for this remedy include extraction wells, a soil irrigation system, and a water treatment system.
These capital costs have been estimated as: $ 4.5 million
Operating costs, including monitoring, water treatment, and well maintenance total: $ 7.7 million

Total costs for Area S1: $ 12.2 million.

TABLE 10-1 - SUMMARY OF MAJOR+ REMEDIAL OBJECTIVES

	Total Carcinogenic PAHs	Dioxins/ Furans	Arsenic, Chromium	PCP
Soil	0.19 ppm	30 ppt	background#	17 ppm
GW	7 ppt	0.53 ppq*	background#	2.2 ppb

+ - The remediation goals for these four contaminant groups correspond to all goals specified in Table 2-3 of the Feasibility Study report since the remedy selected is expected to meet all goals when these four have been achieved. These were selected for this table for brevity, and because they have the most extensive impacts on the volumes to be remediated. Remedial objectives for all contaminants of concern are required to be met.

ppm = parts per million

ppb = parts per billion

ppt = parts per trillion

ppq = parts per quadrillion

- The objectives for remediation of arsenic and chromium are to address all levels above background. The exact background concentrations will be determined during remedial design.

* - Verification of achievement of the goal is limited currently to the analytical detection limit of 25 ppq. Since the remedial action is expected to take 20-30 years, it is expected that significant improvement in analytical methods will be achieved during implementation. Therefore, the remedial goal remains 0.53 ppq, and the analytical detection limit will remain the means of verification as it is improved.

10.1.2 Unit S2 - Excavation and Soil Washing

The selected remedy for soil area S2 is excavation, soil washing, and redisposal of the treated soil. Approximately 200,000 cubic yards of soil exceed the site remediation goals. Those goals especially applicable are 17 ppm pentachlorophenol, 30 ppt dioxins/furans, and 0.19 ppm total carcinogenic PAHs. Dust control measures will be necessary during implementation to prevent airborne migration of contaminants. Treatability studies from other sites has shown promising reduction of PCP and PAHs using soil washing techniques. The details of the washing process, including the types of additives used to promote contaminant extraction, and the number of washing steps necessary, will be determined during remedial design when site specific treatability studies will be performed. Performance of the system will be monitored by chemical analyses of soil entering and leaving the system, and of wash water.

Wash water from this process will be handled in an on-site wastewater treatment system. After treatment wash water may be recycled back into the soil washing system.

It is estimated that remedial objectives will be met for this unit in 10 to 15 years. Total capital costs, including soil washing equipment, the wash water treatment system, and indirect capital costs such as engineering and design, and construction are approximately: $ 7 million.
Operating costs including sampling, excavation, backfilling, grading, and process operations come to: $ 7.6 million.

Total costs for area S2: $ 14.6 million

10.1.3 Unit S3 - Capping with Ground water Extraction

Area S3 will be remediated by the installation of a low permeability cap over the currently active wood treating process area, along with the installation of extraction wells to contain contaminated ground water migrating from this area. For the purposes of this Record of Decision, it has been concluded that this soil can be left in place while plant operations continue without adverse impacts on the surrounding environment. This conclusion will be verified after implementation of the remedy. This is not considered a permanent remedy for this soil. The intent of the selected remedy is to allow continued plant process operations while controlling migration of airborne dust from contaminated soils and preventing the migration of contaminated ground water away from this unit. When the soil is accessible, i.e. when wood treating operations cease, or when process equipment is replaced, these soils will be remediated to the overall goals of 17 ppm pentachlorophenol, 30 ppt for dioxins, 0.19 ppm for carcinogenic

PAHs, and background concentrations for metals (Arsenic and Chromium). Approximately 20,000 cubic yards of soil are contaminated above these concentrations.

The selected remedial action will involve limited excavation to facilitate installation of the cap. The excavated soil will be handled with soil from unit S2. The cap will also serve as a drip track. It will be graded to collect spills and storm water. These waters will be handled in the onsite wastewater treatment unit.

The cap and extraction wells are expected to be operational in 1 to 2 years. Pumping of the extraction wells will continue for approximately 20 to 30 years. Capital costs for this action include excavation and grading, installation of a drip track, extraction well installation, and indirect capitol costs such as engineering and design. These costs total approximately:
$ 1 million
Operating costs are primarily ground water monitoring expenses and are approximately:
$ 200,000

Total costs for Area S3: $ 1.2 million

10.1.4 **Unit S4 - Excavation and Fixation**

The selected remedy for Area S4 is excavation and chemical fixation. This action will need to be taken on soils with arsenic and chromium concentrations above background. The background concentrations of these metals will be determined during remedial design. If the volume of soil with metals levels above background is sufficiently low to make this remedy not cost effective, EPA will consider allowing the soil to be disposed of at a permitted offsite facility.

Excavation and soils handling operations will require dust control measures to prevent the generation of airborne contaminants. The exact mixture of fixation chemicals, along with other process parameters, will be determined during treatability studies as part of the remedial design.

It is estimated that this remedial action can be implemented in one to two years. In order to estimate costs, it was assumed that 4000 cubic yards of soil exceed the remedial objectives. Capital costs will include process equipment and indirect costs such as design and contruction costs. These costs will be approximately:
$ 500,000
Operation costs include the costs for fixation chemicals, excavation and backfilling, and chemical analyses. These costs are estimated as:
$ 500,000

Total costs for area S4: $ 1.0 million

10.2 Selected Ground water Remedies

10.2.1 Remediation of Contaminated Ground water

The selected ground water remedy includes extraction of contaminated water, treatment with activated carbon, and disposal of the treated water by injection wells. In order to meet remedial objectives for both on and offsite ground water, it is estimated that 6×10^8 cubic feet of ground water will need to be treated.

Remedial objectives for ground water are based on the more stringent of 10^{-6} excess cancer risks from use of ground water as a drinking water supply or state action levels. These objectives are 2.2 ppb pentachlorophenol, 7 ppt total carcinogenic PAHs, 0.53 ppq dioxins, and background levels of arsenic and chromium. If the remedial objective for dioxins cannot be achieved due to analytical limitations, the objective will be the lowest available detection limit. Remedial Objectives are presented in Table 10-1.

Onsite ground water contains metals and oil in some locations. These components will need to be removed by pretreatment prior to use of carbon to meet discharge requirements.

Onsite disposal of treated ground water (defined as disposal within the site boundaries or within the contaminated area) will need to comply with the substantive details of California Regional Water Quality Control Board permit requirements for disposal to ground water.

Carbon regeneration will be handled onsite in a biodegration process that will be demonstated during treatability studies as part of remedial design.

The ground water remediation will need to operate for an estimated 20 to 30 years. Capital costs for the ground water remediation include installation of extraction wells, recharge wells, treatment equipment, along with indirect capital costs such as engineering and design, construction and permitting. These costs come to approximately: $23.1 million
Operation and maintenance costs include monitoring, well maintenance, treatment system operation and maintenance for a total of: $ 25.6 million

Total costs for ground water: $ 48.7 million.

10.2.2 Provision of Alternative Water Supply

The selected ground water remedy also includes the provision of an alternative water supply to prevent the use of contaminated residential wells and the use of wells that could adversely impact the ground water remediation. Thus residents that currently receive domestic water from an alternative supply would be provided with sufficient water for all uses (including irrigation). If contamination above EPA's remedial objectives is found in residential wells that are not serviced by an alternative supply, the supply will need to be extended to these wells. If it is determined that the use of any well adversely affects the ground water remediation, an alternative supply will need to be provided to this user.

11.0 Documentation of Revisions to the Proposed Plan

In the proposed plan, the remedial objective for dioxins in soils was presented in the range from 30 parts per trillion (ppt), to 1 part per billion (ppb). The 1 ppb level is the Centers for Disease Control's recommended remedial objective for Superfund sites. This may be adjusted to reflect unique site circumstances and additivity of risk from multiple carcinogens.

Comments on this range of objectives for dioxins (30 ppt - 1 ppb) were received during public comment on the proposed plan. Input from the State of California agencies and community were considered as modifying criteria (see Section 9 for a discussion of EPA's nine evaluation criteria). The comments supported the 30 ppt cleanup goal.

As this Record of Decision documents, remediation of soils by in situ biodegradation and soil washing will be further tested during Remedial Design to demonstrate effectiveness in reducing the levels of dioxins. The RI/FS developed by Koppers indicated that dioxin levels in soil might be reduced by insitu biodegradation and soil washing in areas S1 and S2 respectively. EPA has decided that since these innovative technologies have not been demonstrated to achieve treatment goals and implementation is expected to take 20-30 years, the treatment goal for dioxins is appropriately set at 30 ppt, which must be achieved by the in situ biodegradation and soil washing processes to the maximum extent practicable. Should the technologies fail to achieve the 1 ppb level at a minimum, this ROD will require amendment to select further remedial action. This approach is within an acceptable risk range.

12.0 Statutory Determinations

The selected remedies are protective of human health and the environment as required by Section 121 of CERCLA. Existing or potential risks from exposure to soils and ground water will be addressed by treating contamination, stabilizing contamination, and by containing contaminants. Remedial objectives are to reduce excess cancer risks to 10^{-6} when possible (if background levels of chemicals do not exceed this risk level), and will reduce risks to within the 10^{-4} to 10^{-7} risk range. Risks from noncarcinogens will be reduced to hazard indices less than one.

During the implementation of the remedy, engineering controls will be utilized to ensure that contaminant releases do not pose unacceptable risks. As an example, when contaminated soil is handled and treated, it will be necessary to take dust control measures to prevent the airborne migration of contaminants.

The selected remedies will comply with ARARs and TBCs. The selected remedies will meet Safe Drinking Water Act MCLs, and the California DHS Applied Action Levels for drinking water.

The remediation of contaminated soils will comply with the RCRA Land Disposal Restrictions (LDRs) where applicable. LDRs are applicable to CERCLA actions only when they constitute placement of RCRA-restricted wastes. RCRA-restricted wastes are found onsite in area S2 and potentially in area S4. If the waste is consolidated or otherwise moved within the area of contamination, LDR is not an ARAR since placement is not involved. If a RCRA waste is present that does not currently have a treatment standard (to be determined in this case by EP toxicity for area S4) and placement occurs after the waste is restricted, the remedy must comply with LDR. If treatment cannot meet delisting criteria or BDAT standards, a treatability variance may be sought.

During implementation of the remedies, the substantive requirements of the Butte County Air Pollution Control District will be met.

The aforementioned protectiveness and compliance with environmental requirements is achieved in a cost effective manner. The alternatives chosen are the cost effective approaches available to achieve the necessary degree of protectiveness. Remedial actions for soils in area S4 could change if it is determined that the volume of soil to be addressed can be more cost effectively addressed by disposal at an offsite facility.

The selected remedies utilize permanent solutions and alternative technologies to the maximum extent possible. Remedial actions for soils at S1, S2, and S4 will consist of permanent solutions. The ground water remedy is also a permanent solution.

The containment of contaminated soil at area S3 is not a permanent solution but is protective while being cost effective in minimizing disruption of the manufacturing processes at the site. It should be noted that this ROD calls for a long term remedy of soil in S3, when it is accessible, which would be a permanent solution.

In situ bioremediation, soil washing, and bioregeneration of activated carbon are all innovative, alternative technologies that are part of the selected remedy.

The selected remedies also satisfy CERCLA's preference for treatment as the principle element to reduce toxicity, mobility, and volume of contamination. Remediation of soil units S1 and S2, along with the ground water remedy will be treating contamination to reduce toxicity, mobility and volume. The approach selected to address soil in S3 will only treat to reduce mobility of contamination. Due to the nature of this contamination, this soil cannot be treated to reduce toxicity and volume without excavating the soil. This cannot be done without unnecessarily disrupting wood treating operations.

The selected remedy for soil in unit S4 involves treatment to address mobility and toxicity. This approach effectively protects public health in a cost effective manner. The total volume of the treated material will be in excess of the original waste volume, because of the addition of a fixation agent.

The five year review required by section 121 of CERCLA is applicable to these remedial actions. Those actions that will result in permanent destruction of the contamination will not be completed within five years of implementation of the remedies. The selected actions at S3 and S4 will leave some hazardous substances onsite, and it will be necessary to periodically review the effectiveness of the remediation.